Opportunity Recognition as Creative Thinking

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Theoretical Considerations and Empirical Results on Cognitive Styles and Abilities in Discovering Entrepreneurial Opportunities

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ABBREVIATIONS

A	action	*II*	irrelevant information
ATS	average relative time-spent measure	*IPP*	Information Processing Paradigm
C	constraint/restriction	*IPS*	Information Processing System
CC	category combination	*IS*	information search
CI	contradictory information	*ME*	means-ends framework
CS	category selection	*NPR*	new problem representation
d.f.	degrees of freedom	*OR*	opportunity recognition
E	external world	*p*	path coefficent
e.g.	for example	*P*	principles
EA	economic agent	*p.*	page
ed.	editor	*pp.*	pages
eds.	editors	*PC*	problem construction
ES	economic situation	*PR*	problem representation
et al.	et alii	*r*	empirical correlation
f	human knowledge category	*RTS*	relative time-spent measure
FTV	fuzzy-truth-values	*S*	social peering
G	goal	*SEM*	structural equation modelling
GH	general hypothesis	*SH*	sub-hypothesis
I	information	*t*	time
i.e.	in other words	*TI*	types of information
ICC	interrater agreement coefficients	*TR*	tentative problem representation
IE	information encoding		

"If I were to wish for anything, I should not wish for wealth and power, but for the passionate sense of the potential, for the eye which, ever young and ardent, sees the possible. Pleasure disappoints possibility never. And what wine is so sparkling, what so fragrant, what so intoxicating, as possibility!" (Søren Kierkegaard 1843)

I. Introduction

A. Research Problem

The present work is dedicated to the recognition of entrepreneurial opportunities; probably one of the most fascinating entrepreneurial behaviours. And indeed, many scholars in the field regard this activity as the core of entrepreneurship, building a kind of opportunity school within the scientific community (Grichnik 2006). Whether put as impressive and dramatic creative destruction (Schumpeter 1934) or more modestly seen as the alertness for relevant information (Kirzner 1979), it is the identification and exploitation of opportunities that is seen as the central entrepreneurial element (Shane 2003).

However, many scholars in the field of economics do not account for this genuine creativity of economic agents introducing novelty and change; conscious of the fact that actually other methods and models ought to be implemented, they restrict themselves to exact methods and mechanistic models: "Now we know that the actual experience was not an equilibrium experience; there were surprises, and unforeseen changes of cause. But it is hardly possible that the hypothetical experience should not be an equilibrium experience, for it is under our control, so there can be no surprises in it. If then we compare the actual experience, which is not an equilibrium experience, with a hypothetical experience, which is, we are cheating; so to make the comparison fair we are bond to doctor the actual suppressing the surprises, even though we admit they are important." (Hicks 1979, p. 56)

The present work tries to look at this creative element, arguing that change and progress, whether in economic systems, sciences, or wherever, seem to originate in the recombination of known structures and their reinterpretation in a new context (Röpke 1977).

B. Purpose of Study

Admittedly, the recognition of entrepreneurial opportunities by individuals is a fairly diverse and complex phenomenon (Gartner and Shaver 2004), reason why it seems necessary bringing together central insights in such fields as economics, business studies, and psychology in an interdisciplinary manner. However, whatever perspective is chosen the main issue in research on opportunity recognition are the underlying dynamics of how and why some people and not others are able to discover and exploit particular entrepreneurial opportunities (e.g. Baron 1998; Gaglio 2004; Gaglio and Katz 2001)?

During the last decades, most scholars tried to explain this central phenomenon of entrepreneurship as a function of the types of people engaged in entrepreneurial activity; this perspective resulted in a neglect of the role of opportunities (Eckhardt and Shane 2003). In the 1960s and 1970s a variety of studies (e.g. McClelland 1965) intended to shed light on personalities, backgrounds, early experiences, and traits reported by entrepreneurs and non-entrepreneurs (Baron 1998; Ucbasaran 2004). However, the rationally inferred conviction "[…] that these people were somehow distinct" (Mitchell et al. 2002, p. 95) was not supported empirically with these studies since they showed weak, disconfirming, or non-significant results (Low and MacMillan 1988; Mitchell et al. 2002; Pendergast 2003; White et al. 2003): not even one unique set of personality traits could be reported by these research efforts (Mitchell et al. 2002). It is argued here that the main weakness of such a person-centric perspective lies in the conjecture of stable differences among economic agents; considering that entrepreneurial activity is episodic, it is unlikely to find personal attributes with a high explanatory power explaining why some economic agents engage in entrepreneurial activity and others do not (Eckhardt and Shane 2003).

However since then there has been a shift in the focus of research in the field of entrepreneurship from the former attempts to identify individuals in society exhibiting certain entrepreneurial characteristics towards an understanding of the nexus of such enterprising individuals and valuable opportunities respectively different economic situations (Baron 2000; Busenitz and Barney 1997; Eckhardt and Shane 2003; Krueger 1993; Shane 2000; Shane 2003; Venkatamaran 1997).

More recently, during the last years, many scholars in the discipline have adopted a cognitive perspective to account for this and to explain entrepreneurial phenomena (Mitchell et al., 2002, 2007). Similarly, in the present work the predominant perspective from which the phenomenon is approached is a psychological one, arguing that such can provide a general framework on this phenomenon. The motivation behind this is the conviction that "[…] cognitive perspective suggests several reasons why some persons are better at the task of identifying opportunities than others." (Baron 2004, p. 67) Such an approach has the main advantage that there is no need to invent new ways of understanding how individuals make sense of their situations because reasonably adequate theories and methods already exist in other disciplines, such as cognitive psychology (Gartner and Shaver 2004).

The present work intends to contribute to entrepreneurship research by choosing the perspective of cognitive psychology; the central question intended to be answered is if there exist certain cognitive styles, preferences, or heuristics an individual applies in processing information that facilitate or inhibit the recognition of entrepreneurial opportunities?

C. Proceeding

In order to answer the central research problem and contribute to the discipline, the following chapter II aims at introducing the general concept of opportunity recognition in entrepreneurship. By reviewing ontological issues, entrepreneurship as research phenomenon, and, based on this, the identification of entrepreneurial opportunities the general fundament is laid for answering the central research question. These considerations will show that particular modes of human thinking seem to be highly determining for this entrepreneurial behaviour.

Therefore, chapter III will deal with the basics of human thinking and cognitive psychology scientifically dealing with it. In order to model the entrepreneur and its thinking in opportunity recognition afterwards, central ideas and terms for conceiving the human mind and human thinking are sketched. Particular emphasis is put on the aspects that characterise creative thinking, especially on individual differences that have explanatory power for assessing variation in creative performance; besides contextual factors given by the situation thinking is situated in, it will become evident that an individual's way of processing information, expressed via cognitive preferences, strategies, heuristics, or styles, is one of the strongest distinctive features in this regard.

Having introduced the phenomenon of opportunity recognition as entrepreneurial behaviour and outlined the concepts and terms to adopt a cognitive perspective on it, the central chapter

IV can finally deal with its detailed modelling. However, before other scholar's efforts to explain entrepreneurship from a thinking perspective are reviewed here; reason for doing this separated from the initial considerations on entrepreneurship is simply that the reader has now been provided with necessary cognitive concepts to thoroughly comprehend these approaches. After treating preliminary thoughts, basic assertions for theorising in the present context and briefly sketching the reference model of creative thinking, part C deals with the actual cognitive model of opportunity recognition. Besides the information processes executed, central cognitive styles are suggested that seem promising in explaining individual differences in the ability to recognise entrepreneurial opportunities.

This rather theoretical treatment provides the hypotheses to be tested in the empirical study outlined in chapter V. There, it is shown how data is collected, i.e. which general survey design, sample, and measures have been chosen to investigate the operationalised hypotheses. Before causally analysing this data concerning reliability and validity of constructs used as well as the hypotheses developed, the basics of such causality analysis and its mathematical foundation, structural equation models, are introduced.

In conclusion, these results are interpreted and discussed regarding their theoretical and practical implications for entrepreneurship theory, practice, and education. Particularly, opportunities to teach the ability of recognising entrepreneurial opportunities via facilitating cognitive styles are sketched and possible starting points for future research given.

> *"Find a scientific man who proposes to get along without any metaphysics […] and you have found one whose doctrines are thoroughly vitiated by the crude and uncriticised metaphysics with which they are packed. We must philosophise, said the great naturalist Aristotle - if only to avoid philosophising. Every man of us has a metaphysics, and has to have one; and it will influence his life greatly. Far better, then, that that metaphysics should be criticised and not be allowed to run loose." (Charles Sanders Peirce, Notes on Scientific Philosophy, CP.1.129. cited in Sowa 2000, p. 51).*

> *"The egregious sin of the standard economist is of another kind. Because he denies the necessity of paying any attention to the evolutionary aspects of the economic process […]." (Georgescu-Roegen 1971, p. 325)*

II. Opportunity Recognition in the Concept of Entrepreneurship

The present chapter II aims at introducing the central footing for theorising about human action in economic systems, in particular entrepreneurial individuals who introduce novelty and induce change and transformation in such systems. It starts with a brief treatment of metaphysical questions in part 1 of chapter A; more precisely it is dealt with the general being or existence of things, i.e. the ontology of the world (Aune 1985), and what humans can know and justify, i.e. epistemology (Audi 2003). Apparently, assuming different perspectives on the world has a significant impact on the way economic agents are modelled in economic theories. Particularly, this applies to such accounts that adopt a relativist view and aim at grasping novelty and change in economic systems; these issues are discussed in the remaining parts 2 and 3 of chapter II.A.

These considerations ought to show that it is the subjective element of specific creative humans that allows introducing true newness in economics: entrepreneurs. The first part of chapter of II.B is dedicated to this group of economic agents. The following part presents a model of economic human action in time that is able to cast truly creative agency, in which the previous arguments on relativist approaches to economics fall into place: During the entire subsequent work, it will be recurred and referred to this basic model in modelling the recognition of entrepreneurial opportunities. Part B of chapter II is concluded by a succinct introduction to the concept of entrepreneurship, which is a process view on entrepreneur's behaviour in an economic context.

It will become evident that, on a basic level, entrepreneurial behaviour is regarded as the identification and exploitation of entrepreneurial opportunities; hence, the latter concept is introduced in the beginning of part C. As the present work is going to deal with the entrepreneurial process' initial stage, i.e. with opportunity identification, the following two parts will briefly review research attempts to model this phenomenon and variables that have been found to determine the recognition of entrepreneurial opportunities respectively.

A. Ontological Foundation

1. Metaphysics: Realism versus Relativism

Evidently, the issue of the relation between the human mind and the external world is as old as Western philosophy itself; however, the clear distinction between mind and matter is often attributed to Descartes (1641). According to his so called Cartesian dualism there exist two different sorts of substances: body and mind, which are utterly distinct and independent of each other. While bodies are just a one kind of matter and, therefore, constrained by the laws of physics, minds are free (Lycan 1999). This was controversially discussed until Identity Theory was introduced and offered a widely accepted solution, which was most important to the development of modern psychology (Place 1999; Smart 1959). According to this view, at least some mental states and events are genuinely inner and genuinely episodic; by no means, this is meant in the sense of dualism since the core is that these mental states are neurophysical, i.e. identical with states and events occurring in the central nervous system (Lycan 1999).

However, leaving out a detailed discussion of the issue whether a border between subject and object makes any sense at all, all philosophical approaches could be located on a dichotomy regarding their ontological stance, marked by the endpoints of realism and relativism (Crotty 1998). Realistic approaches claim that there exists a reality of objects of study independent of subjects, i.e. objects that can be located in time or space. Such approaches aim at proving the objective existence of the object at hand; thus, the truth of a proposition made about them is seen independent of thinking and language. Approaches to realism differ, as indicated by the dichotomy, to the degree to which the subject-independent world can be observed by the human mind: totally, partially, or not at all (Ötsch 2007). For instance, metaphysical realism varies in having rather optimistic or rather pessimistic attitudes as to the perceptibility of our world's structure. An optimistic view would assume that the universe has an intrinsic nature and that it is principally knowable by humans. In turn, less optimistic would be a notion that humans can only attain approximately correct or accurate descriptions of any of the universe's aspects (Grandy 1997). Often alleged approaches to realism are naive realism (Weber 1996), somehow marking the endpoint of the dichotomy because the human mind is seen to have direct contact to the objective world; further streams are representative realism, resembling to Locke's critical realism, or empiric realism often related to Kant, who postulated a world that exists independent of a single creature but not independent of the general existence of perceiving creatures. These creatures are postulated to objectively recognise, for instance in that they can impose the forms of space and time on things (Dancy and Sosa 1992).

The rejection of realism is a central characteristic of philosophical relativism, in which reality and insight about reality are not absolute but relative. From time to time, the terms of metaphysical constructivism or idealism are heard in this context: They refer to such a relativist view that the objects of the world are constructed by humans (Lycan 1999), contradicting metaphysical realism, which claims that it exists independently of minds and thoughts. Within this view it could be differentiated between individualistic constructivism that postulates individual constructions of the world, and social constructivism that postulates shared views or constructions (Grandy 1997).

The elemental arguments of modern relativism could be described by three main theses (Wendel 1990): The first proposition is called (1) thesis of epistemological immanence and asserts that there is no such thing like an external structure of the world since every thing is co-construed by the cognitive subject. It follows that any proposition about the structure of the world is created by the subject, respectively thinking processes in his mind. Therefore, every internal representation of the external world in the human mind does not simply represent, depict, or mirror an external world independent of the subject, but is instead actively construed by the subject. Further, the second main aspect of relativistic approaches is called (2) thesis of the ontological immanence. If the thesis of epistemological immanency is applied to a hypothetical comparison between an imagined object and the same object, how it should look like independent of the human construction; it follows that there cannot exist objects independent of thinking and recognising. Reason is that it is impossible to compare a subject view on a thing to a hypothetically objective thing: to mentally design such an objective thing is seen as a thinking process, which is necessarily subject to individual construction. The third central element or philosophical relativism is could be named (3) thesis of epistemic equality of sets of statements. Most approaches refuse such radical relativism and replace it by the denial of an ultimate instance or method of proof (verification) for an unambiguous and ultimate judgement on rival views of the world or set of statements. Such approaches assume that the available method of verification allows for the existence of different, incommensurate set of propositions, i.e. paradigms and theories, which are seen as equal since none of them can be ultimately proven right or wrong (Wendel 1990).

While naive realism has been named as one endpoint of the mentioned dichotomy, radical constructivism might represent the other: Its assertions are based on modern neurosciences and claim that cognition is pure construction and self-referring since the subject only disposes of knowledge if this is created by own operations in the cognitive apparatus. This strand totally rejects the idea of realities and representations in the sense that cognition has a pure adaptive function, not depicting an objective reality (Nüse et al. 1991). Along these lines, evolutionary epistemologists regard knowledge from an instrumentalist, respectively pragmatic angle since it is assumed to be built up by single ‘concepts’, which first enter the general concept of experience (Glasersfeld 1981). In evolutionary terms, knowledge becomes a selection mechanism, creating viable ways of survival or adoption of the system (in this case the human). Therefore, the system only allows for a finite number of viable ways to work in the experiential world (Campbell 1960).

The approach particularly earns the attribute of being radical because the whole external world is a construct, not represented in the cognitive apparatus, but only functioning as a trigger, selecting the ways of behaviour determined by the cognitive system. External information is not seen as objective data, but as result of internal operations within the structural determinants of the internal system. Put simple, radical constructivism claims that the brain only understands its own ‘language’, which, therefore, can be seen independent of the external trigger since everything has been translated by the sensory receptors. This assumption or view is referring to the principle of unspecific coding of the brain, which means that the sensory receptors of all systems of senses all send similar electronic impulses. Thus, the brain only distinguishes between different degrees of stimulus intensity and not at all between the physical or chemical nature of the stimulus. It is this pure reduction to one quantitative differentiation that leads radical constructivists to deny a relation between any characteristics of a subject-independent external world and human cognition. This means that radical constructivism regards the human mind, respectively the brain, as an autopoietic system (Dzurisin and Segal 2001; v. Foerster 1985; Nüse et al. 1991). Such systems are characterised by circular processes, i.e. the fact that all components are organised cyclically and reproduce themselves within the system. Important is that such autopoietic systems operate closed, which means that each state is determined by previous states. Such systems can only be influenced externally as far as allowed by the internal organisation of the system. This finally implies that external objective components totally lose their relevance; they are constructions of the human mind (Nüse et al. 1991).

As already said, the majority of arguments brought up against such radical constructivist approaches object that it is principally impossible to justify relativist positions, if they are applied to themselves (Ötsch 2007). Some of the main arguments criticising relativistic and radical constructivist positions are: How can relativistic propositions be true if truth is only a subjective category? Similarly, it could be asked how their approach can be based on empirical neuroscientific results, because if this is accepted, such data is somehow realistic. Furthermore, it is often objected that relativistic models can only be one instrument to explain scientific propositions since according to the third thesis regarding epistemic equality all theories are regarded as instruments. Additionally, it is asked how scientists as observers, who are a closed system themselves, can make any assertions about the human mind if it is a perfectly closed system existing independent of cognitive worlds and gives rise to such (Wendel 1990)?

It is argued that such approaches cannot be finally proven right with their own methods of verification since they do not allow for absolute and objective facts. The thesis of epistemic equality of sets of statements offers a solution to the circular problem of relativist philosophical approaches: Given this premise, it is simply unnecessary to base constructivist epistemological positions on absolute theses since it cannot be proven right anyway. Accordingly, more recently approaches based on relativist arguments to varying degrees can be found in many sciences in one form or another. Practically all post-modern approaches contain relativist elements, often emphasising the historical, social, and cultural relativity of ideas and knowledge, thereby criticising all purely positivistic and empirical-oriented sciences. Consequently, empirical data is regarded as interpretative construction.

Generally speaking, in the field of psychology, important to the present work, the term constructivism stands for such approaches that refrain from representational theories of perception. These regard perception and cognition as passive-receptive processes of depicting external stimuli into internal images in the tradition of Descartes (1641). The whole process is therefore predominantly determined by the external stimuli to be translated. In contrast to such representational theories, constructivist approaches consider perception and cognition to be active, nevertheless often subconscious, selection and composition processes. Perception is not simply determined by external stimuli, but a creative mixture of external and internal information since external stimuli are creatively framed by extant knowledge structures, say memories, heuristics, etc. This process results in cognitive constructs or mental models, not passive pictures of the external world; this view is called cognitive constructivism and could be seen as the view that individual cognitive agents understand the world and make their life by using mental representations that they have constructed strongly based on their personal history (Grandy 1997; Ötsch 2007).

Consequently, the central statement of cognitive constructivism is that whatever is momentary available in memory is product of a constructive process in which the conscious thought is built deliberately (Seel 2000). This also means that human memory and knowledge are not accurate archivists, but rather continuously alter our episodic knowledge (Seel 2000). This assertion requires here to underline that the term representation, used quite often later on in this work, does not refer to a realistic philosophical position, but rather merely denotes the result of the construction process in an individual's mind. In this view, cognition is rather is the confirmation or rejection of a hypothesis that an individual builds about the situation in a given moment in time (Pöppel 1988).

The fact that an individual's episodic memory adjusts our past to the present need and primarily intends to be consistent with the particular environment and its requirements can be shown quite evidently by briefly presenting a study of Neisser and Harsch (1992). One day after the Challenger crash (a crash down of an US-American space-shuttle in 1986, in which seven astronauts died) they asked college students to write down answers to seven questions concerning the circumstances they came to know about the accident. Then, three years later, the students were confronted with the same questionnaire: Approx. 75% of the students did not even recall that they had already answered exactly the same questions, and in average only 2.9% of the answers were consistent with the answers given right after the crash. One fourth of the students did not even answer one question concordantly.[i] Even more surprisingly, hints and suggestions as to their initial answers were not able to refresh their memory and a lot of the students were surprised hearing their original answers. In addition to these findings, the students' conviction of accurate memory was barely correlated positively with their statements' accurateness in the sense of concordance (Neisser and Harsch 2000). This exemplary study underlines a central proposition of cognitive constructivism: Knowledge is not seen as a reproduction of something in the external world; it is a personal construction with which the individual constructs meaning by connecting parts of knowledge and experience with organised extant knowledge structures (Resnick 1985).

Although economics do not deal with epistemological issues in a first instance, it should be quite palpable by now that it is an extremely important issue insofar that the epistemological and the observer problem are relevant to economic theorising as for any other social science. The view assumed by the scientist in this question is crucial since it lays the fundament for each economic theory, for methodology allowed, for policy implications, and of course, the role of the economist himself (Ötsch 2007). Hence, the following paragraph will sketch differences in modelling economic behaviour subject to a realistic or relativistic ontology.

2. Modelling Economic Agents

Regarding the question how to model humans in economic theories, the stance of realist philosophical approaches that human cognition is able to accurately represent the externally given structure of the world in the sense that it is reproduced perfectly, if no disturbing factors interfere the process of perception implies that the economic agent can principally come to a state, in which its subjective representation equals to the objective phenomenon. This implies for the analysis of economic phenomena that the researcher assumes, without any explicit epistemological explanation, that economic agents have accurate information about a given reality (Hesse 1990). As many scholars point out, e.g. Hesse (1990) or Gerrard (1993), mainstream economics, largely bound to this fundament, was thereby able to take advantage of the application of exact theories to investigate economic phenomena.

Ontologically, the fundament for all these models is a mechanistic view of the world. It is assumed that everything in the world is principally conceivable as a machine. Already Adam Smith (1776) considered everything to be subject of a big plan of nature. This view has the comfortable methodological advantage that every process in time can be logically deducted if the exogenously given laws of nature at work and the initial conditions are known to the researcher (Coulter 1996).

Consequently, the main task of the researcher in such deductive-nomological models consists in reducing the incomplete information about the law-like generalisations in order to find out, how the machine at hand works; many scientists even claim that it is the only way economic science can be done (Morgenstern 1976; see for an overview Arrows and Intriligator 1981). Scholars alleging this approach claim to do exact science since they are based on logic (Blaseio 1986) and, therefore, use exact methods of thought (Morgenstern 1976), claiming that theories and laws that are developed in such a manner apply universally in space and time (Dopfer 2001).

Similar to such an evidently unrealistic conjecture of perfect information in objective manner early theories on human decision making, still dominant in neoclassical economics, assume rationality to prevail. Bascially, rationality in economics is seen in instrumentalist terms, i.e. that the rational agent makes choice of optimal means to given ends (Gerrard 1993; Robbins 1932). It is assumed that each individual is confronted with an economic problem, in which it must select courses of actions that will secure the fulfilment of as many of its goals with respect to given means; often called securing efficiency or maximising goal satisfaction (Kirzner 1973). The common feature of all such Robbinsian formulations of the problem is the need to achieve the pattern of manipulation of given means that will correspond most faithfully to the given hierarchy of ends. Such an economic agent is aware of a complete set of alternatives, in which such rational decisions can be taken according to objectively ascertainable utility functions (Blaseio 1986). Giving an example, a pioneering work introducing several axioms that were assumed guiding a rational decision maker’s preferences has been published by Neumann and Morgenstern (1947).

Subsequently, several influential contributions have been made that showed aspects of decision making behaviour that differ from rational choice and claimed for the introduction of more appropriate, respectively more realistic descriptions. Among such approaches, Simon’s (1955) concept of bounded rationality definitely ought to be mentioned. His term was intended to express that human agents aim at taking rational choices, but are limited in their cognitive capacity to process all relevant information (see also chapter III.B.2), and, therefore, are inherently subject to uncertainty that prevails in making decisions. These neurophysiologic limits result in that humans cannot consider ex ante all eventualities (Feldmann 1999).

Although realist approaches have recently intended, and apparently achieved, to draw a more realistic picture of economic agents, they are still all based on the central conjecture that the human can be modelled as an automaton. From such a perspective, they only assume that the mechanism is (so far) too complex to be fully understood and modelled in nomological-deductive models (Hesse 1990); anyhow, it is principally possible. However, subsequent studies and discussions revealed that their axioms of rational choice are generally of rather normative nature and not realistically describing or predicting observable decision making by humans (Kahneman and Tversky 1984). If such effects, e.g. framing, can be observed in experiments, it must not only be asked if they can also been find in real-life situations, but also whether they should be considered as anomalies, which would a realist philosopher claim, or ubiquitous phenomena following a relativistic position?

However, gradually the passive picture of perceiving humans in philosophy has disappeared and given space to so called subjectivist views on epistemology as an active process, having an influence on the conceptualisation of human agency in economics. Directed to the scholars that defend exact sciences as the only way for doing research it could be argued that Gödel's theorems in mathematics or Schrödinger's arguments in physics show that formal methods of exact sciences are not per se capable of describing a complete field of study; in each of field objects can be identified, which cannot be captured with axiomatic-deductive models (Hesse 1990; Ötsch 2007).

According to such an argumentation most criticism concerning neoclassicism in economics can be traced back to the immanent characteristics of formal languages, such as mathematics, on which they are built (Blaseio 1986). One main argument against the application of exact methods in some fields of social sciences is that logic seems no to be as neutral as many scholars allege (e.g. like Morgenstern 1976), insofar that the use of mathematics introduces a somehow alien element into social sciences (Blaseio 1986). Nevertheless, it seems that mainstream economics prefers to base its theories and models on the exact approach, which turns out to be an anachronism since mathematics and physics have already abandoned the claim of an omnipotent formal analytic (exact) picture of the world, admitting the foundational crisis of mathematics (Blaseio 1986; von Weizsäcker 1977).

The fact that the implications of this foundational crisis have to a large extent not been noticed by the social sciences is now taking vengeance. Consequently, it must be criticised that many scholars seem not to realise that the mathematical analysis can no longer be seen as apodictic truth in any field of economic study, but might result in sets of objects, which are highly consistent but not explain the phenomena at hand. It is the central insight that already Einstein and Bohr were confronted with that concepts, in which simple empirical theorems are formulated, only become a clear sense in relation to a theory, a framework they can be understood in (Weizsäcker 1977, p. 583). This textual vacuum is particularly devastating in theories of human action or behaviour that are committed to formal consistency, and, therefore, immune against mathematical criticism, but while useful in explaining a variety of things, definitely do not explain historical or emerging events that characterise human behaviour (Blaseio 1986).

In a way, the important works of Max Weber, Karl Popper, and Friedrich von Hayek in social sciences all claim as central point that there exists no such thing as conscious perception or cognition without active interpretation (Hesse 1990; Koch 1998). In particular Max Weber and Alfred Schutz argued that, therefore, not only action but also meaning attributed to it, must be considered in doing research on economic phenomena, thus, being epistemologically committed to fallibilistic ideas (Morton 1977; Weick 1969, 1995). They particularly emphasise that an understanding of economic actions like coordination must also be based on actions and the interpretation of their meaning by other economic agents (Yu 2001). Thus, this view alleges that interpretation is a highly social phenomenon since "[…] it is a process of perceiving the other and him or her interaction within symbolic frameworks so that we can make some sense out of what the other is doing." (Weigert 1981, p. 74)

Since such questions touch the underlying ontological level, they have deeper implications than simply assuming that humans are limited in their capacity to reproduce the one and only structure of nature, ruled by the laws of nature; central terms of microeconomics even lose their meaning. Therefore, it is now briefly outline how economic agents are modelled in relativist economic theories.

Assuming a relativist or constructivist position in opposition to the prevailing, explicitly or implicitly realism-based models of economic agents leads to paradigmatic changes: In the present context particularly the terms of complete and incomplete information about which an economic actor can know, or not, are touched since they become misleading in their original neo-classicist sense. The central research question in this context shifts from defining the degree to which an individual possesses information about a situation and options of action, which accrue from it, i.e. the question how much information is gained, to questions of which information and of what type are considered and used by the individual; i.e. which information and how (Hesse 1990). Expressed in general terms, " […] the question whether some idea is 'objective' is itself a matter for subjective judgment […]" (Shackle 1979, p. 30), i.e. a matter of public and general acceptance (Shackle 1979).

A relativist ontological stance also resolves the bounded rationality-problem of microeconomic decision models: The core of the problem is that most real world problems are so complex that the human mind is not able to process all information available and relevant. However, in a subjectivist view even complete information, in the sense of having all relevant information available, does not lead to perfect equivalence of the subjective and objective situation. From such a view follows that it is methodologically ineligible to assume simple situations in which such equivalence might prevail; ontologically argued such situations do not exist and make these questions negligible. What mainly remains is the question, which information is processed and considered by a specific subject in time (Hesse 1990).

Approaches and theories that assume human agents to actively interpret their environment are often called subjectivistic; one term for the philosophical conviction that imputes primacy to subjective experiences as fundament of all human observations and actions (Farber 1959). In economics it is said that during the last decades modern Austrian economics has emerged out of the classical subjectivist tradition (see Buchanan 1982; Coats 1983; Lachmann 1982).

Often cited in this regard is Lachmann's radical subjectivism that mainly embraced three interrelated themes: the (1) explanatory primacy of subjective evaluation, the (2) importance of expectations, and the (3) inadequacy of equilibrium models of the market (Koppl and Littlechild 1986; Mongiovi 1998; Zappia 1998). He viewed historical events as the outcome of purposeful human action that originates in the formation of plans. Since it is purposeful action that economists seek to understand, their principal task, according to Lachmann, is to elucidate the mental processes by which plans are formed. His interpretation of subjectivism entails the individualistic methodological doctrine that economic explanation must trace all causality to such mental acts, which differ from person to person.

Lachmann distinguished three levels of subjectivism (Lachmann 1990). First, the subjectivism of wants recognises that different people have different tastes and pursue different ends. Second, the subjectivism of ends and means recognises that people may pursue similar ends in dissimilar ways. People have diverse, sometimes erroneous, ideas about the best ways to achieve any goal. Finally, the subjectivism of active minds embraces that in all aspects of action the active mind may produces interpretations and possibilities the observing economist can imagine in advance. For him subjectivism means "[T]he mental activity of ordering and formulating ends, allocating means to them, making and revising plans, determining when action has been successful, all these are its forms of expression." (Lachmann 1982, p. 37)

The radical subjectivism to which Lachmann was committed went far beyond the specification of agents' references as part of the data which regulate prices, outputs, and distribution in a market economy. Instead, his notion of subjectivism derives from the fact that agents must form plans on the basis of their interpretation of events that take place in a changing world about which they have incomplete knowledge. The mental acts that precede action are therefore the products of human ingenuity - imaginative responses to the uncertainty of social existence - and are, to a significant degree, based on agents' expectations about nature's future states.

Early on in his work, Lachmann (1943) stated that expectations are themselves shaped by the course of economic events; they cannot be regarded as parametric. Nor, according to him, can any scholar connect them in any systematic way to observable phenomena: Lachmann denies the possibility of establishing any univocal link between events and the expectations to which they give rise, assuming a rather radical constructivist position and denying the value of nomological-deductive models of human action. A given configuration of events, he argues for instance, can generate any number of expectational responses. For example, considering a price rise in a particular market could lead some agents to expect further price increases and others to expect a reduction in price, with corresponding consequences for theirs subsequent actions. Thus, expectations "[…] have to be regarded as economically indeterminate." (Lachmann 1943, p. 67)

As already indicated, various studies found arguments substantiating a subjectivistic view. Many of these studies were based on psychology, leading to the emergence of research strands such as behavioural or cognitive economics. Very prominent amongst such findings are so called framing effects in human behaviour. Mainly referring to the axiomatic principles of dominance and invariance[ii] in rational choice, Kahneman und Tversky (1979, 1981, 1984) argue that human decisions are subject to such effects. The term refers to subjective, non-rational perceptions of decision situations, which elicit observable decisions and are predicted differently by rational choice theory.

It was shown in empirical studies on expected utility theory that the choices of individuals are significantly influenced by the framing of the situation (Ötsch 2007). In such experiments on economic agent's decision making, subjects changed their decisions regarding the same facts such as payoffs or occurrence probability if other decision frames were offered to them. For instance, it matters for the choice of individuals if the possible outcomes of a gamble are framed either as gains or losses relative to the status quo or as an asset position that incorporates initial wealth (Tversky and Kahneman 1981). Most notably, even individuals that were informed about framing effects still were not invariant to options that were rationally equal. This leads to the conclusion that framing effects rather resemble perceptual illusions than computational errors (Kahneman and Tversky 1984).

By illustrating further effects of the influence of mere framing of outcomes and contingencies in decision situations on decision behaviour, it is pointed to an individual's subjective representation of a situation. This also equals to subjective values and utility functions that are underlined in the psychophysical treatment of risky choice, called prospect theory (Kahneman and Tversky 1979).

About the same time Kahneman and Tversky published their results, extended research on organisational decisions - linking individuals' cognitive representations of the environment and organisational actions - has highlighted that decision makers have interpretational frameworks on which they base their decisions since the issues they encounter are mostly ambiguous and therefore require interpretation (Dutton and Jackson 1987; Daft and Weick 1984; Jackson and Dutton 1988; Kiesler and Sproull 1982; Miller et al. 1982). In particular the role of schemas is underlined in categorising perceptions of a situation. This notion is based on cognitive economics literature (Earl 1983), arguing that under genuine uncertainty, human agents attempt to cope with the stimuli of the external world by constructing, templates of features of the world and then seeing whether or not these templates actually fit (Yu 2001).

Reviewing literature on human cognition, it soon becomes clear that all the arguments brought up are common knowledge on human cognition applied to economic situations or settings. For instance, it is said that if humans are confronted with a particular situation, they endeavour to derive a set of usable conceptions of the external world through mental experimentation based on experiences, i.e. humans categorise the situations they are confronted with to give them a meaning; to interpret them (Choi 1993). Such categories are mainly built up by previous experiences and associated with particular actions (Lane at al. 1996), accumulated in everyday situations, and largely biographically determined (Berger and Berger 1976): It is dealt with idiosyncratic stock of knowledge that is used to interpret incoming events (Yu 2001). The past actions are adjusted to the present situation, which is similar (by definition perceive similar since it is activated) but not identical to the one it is categorised to (probably derived from the prototype and the attached action taken to react to the situation).

Summarising this, economic agents have made previous experiences, which make up an idiosyncratic stock of knowledge; new economic situations they are subsequently confronted with are understood by the personal interpretation framework, which is based on the stock of knowledge. Then, the experience gained from this situation is added to the stock of knowledge, thus also influencing future decision making (Shane 2000). Resulting, individuals possess routines or rules of thumb with which they solve problems in everyday life (Yu 2001). Such interpretative concepts - often named routines (deBono 1980) - are crucial for human life, consequently also for economic actions. In addition, it implies that economic agents react differently to an objectively similar stimulus (when other economic approaches just see the situation at hand, assuming a homogenous behaviour (mostly rational) (O'Driscoll and Rizzo 1985) and make up different expectations of the future (Lachmann 1970). What is the conclusion of this proposition for the present work? Hereafter, it is assumed that effects, such as framing, are not simply an empiric heuristic problem but indicate a basic epistemological problem of each economic theory.

According to Hayek (1945), in economics a twofold subjectivism prevails, which imposes a basic problem of generating relevant knowledge on economic agents and scientists (Wegner 1996). This is the crucial point where creativity comes into economics: Alternatives or options for action do not exist in the world, but are the result of mental hypotheses about possible alternatives or options (Hayek 1956; Lachmann 1979). Simultaneously, subjective creativity - in the sense of producing novel outcomes - is the source of endogenous change and will be the main topic of the present work, marking the central characteristic of special economic agents: entrepreneurs. It has been outlined above what it basically means to assume a relativist or subjectivist stance in theorising about economic human action. However, nothing has been said yet about some implications such a view has for explaining entrepreneurial behaviour.

3. Time and Novelty in Relativist Economic Theories

Adopting a subjectivistic or relativistic view, the economist as a scientist is confronted with the epistemological problem that an individual's perceived options of action can only be partially deduced by objectivated model data. It is not observable how these data are transformed into options of action, in particular if these are novel (Hesse 1990; Ötsch 2007). For scholars the main problem arises that it is impossible to accurately identify, what part of human cognition can be attributed undoubtedly to a subject-independent external world. However, this does not automatically imply that there is no such neutral or objective reality existing (Crotty 1998), but rather that there is an inescapable mist covering all assertions, in particular also involving the scientist as a subject himself (Koch 1998).

What is most relevant to the present work in that regard is that in a mechanistic world, creativity or the introduction of novelty is attributed to a creator outside the machine, who moulds law-like generalisations (see left hand-side in Figure 1). Admittedly, parts of the world can be described and understood in this sense (von Förster 1985); however, many economists, amongst them Austrian economists and evolutionary economists, accept such a mechanistic model only for parts of the world; these are embedded in processes that cannot be described as machines (see right hand-side in Figure 1) (Herrmann-Pillath 2001; Hesse 1990): The formal analytic view of the world is applicable to fields in which structure and order, i.e. stability, prevails but not to phenomena in which novelty and change are decisive (Blaseio 1988); i.e. to real economic evolution (Georgescu-Roegen 1971).

In methodological terms, it follows that quantitative, statistical data and econometric methods can only be applied to certain parts of the object of study. Concluding, knowledge about facts and options of action economic agents possess in a situation are not objective in the sense that they can be deducted from given external information, i.e. market data. Rather it is a subjective process of interpretation, which finally leads to the subjectively perceived options of action.

Assuming a mechanistic stance based on logic, the classical view of homo oeconomicus is quite reasonable since it is located in a bivalent world: In such, the postulate of identity prescribes that a thing can only exist or not. This implies an objectivity of the world, in which an individual can objectively recognise the world around him (Blaseio 1988). However, as has been said such a metaphysical view of the world is outdated; therefore, a variety of efforts to implement more realistic models of humans as economic agents have been taken recently.

In particular, evolutionary economics consider the integration of the creative element as essential part of human behaviour in economic situations as one of the most important aspects, distinguishing it from other approaches (Budzinski 2001; Coriat and Dosi 1998). Similarly, such subjectivism is often seen as the fundamental tenet distinguishing Austrian economics from neoclassicism (Horwitz 1994). Following such a position brings up another important aspect: the issue where the border lies between phenomena that can be modelled as a machine and, therefore, can be investigated with exact methods, and creative elements or processes that elude from such approaches.

It is important that researchers are aware of the border of their models and theories and do not limit their research to a too narrow field of research they regard as representing the complete field that can be modelled like a machine (Eucken 1939; Hesse 1990); a research field with aspects that ought to be modelled different is schown on the right-hand side in Figure 1. It is most important to the present work to consider this assertion since it might be objected that a subjectivistic approach to economic phenomena must result in a historic science, simply explaining phenomena ex post, simply because the introduction of inherent novelty alters the laws at work (Blaseio 1986).

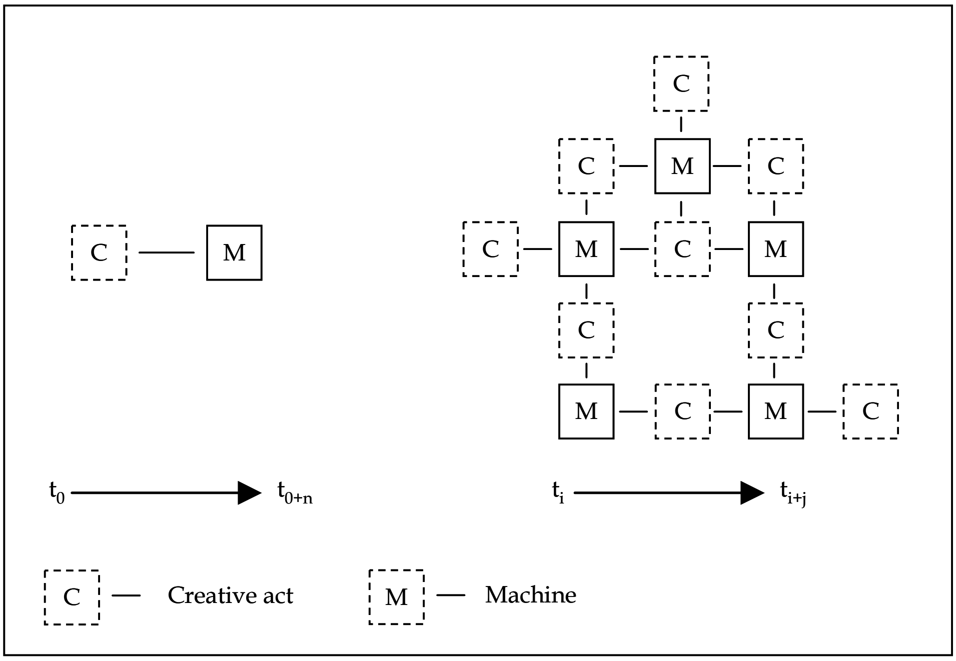

Figure 1 Ontological Controversy: The world with endogenised and exogenised creativity (based on: Hesse (1990), p. 54).

However, the present work is not intended to theorise about singular changes, but about the whole process dealing with classes or types of information and information processes that are used by all human actors to produce novel conjectures. This is exactly the argument, which is brought up by evolutionary economists, who accept that singular processes of change cannot be captured with any metaphysical approach and therefore focus on the variation and selection processes that influence the whole process (Dopfer 2001; Herrmann-Pillath 2001; Metcalfe 2001), thereby clearly defining what can be investigated with their models and what cannot.

Summarising these arguments for the purpose of the present work, it can be stated that the human mind of economic agents at a certain point in time offers different alternative representations of a situation in the external world based on their previously accumulated stock of idiosyncratic knowledge (Koch 1998). For somebody not too familiar with economic theories it might be surprising that time as a relevant factor is so explicitly mentioned in a work like the present. However, it is that in many approaches of mainstream economics time is not considered as a relevant dimension since the formal analytic view is based on the logic of being that needs no time or subject (Blaseio 1986). Time is regarded as a frame, an ether, that comprises all economic agents and all their actions; and while humans act in time, neoclassical economics stays principally objective and timeless, thereby excluding surprise, novelty and everything unpredictable, i.e. inherent change (Röpke 1977; Shackle 1972).

Reason is that time has been rejected in such economic theories in order to achieve demonstrative proof (Shackle 1972). Simultaneously, the main argument that is brought up against time as a mere dimension of space based on exact sciences and the formal analytic approach. Thus, even though the future is not necessarily modelled deterministic, probabilities of occurrence can be given for possible future events, and, thereby, endogenous novelty can be excluded (Blaseio 1986); by doing so, time is modelled as a spatial coordinate (Hicks 1976). Such a set of potential states is only based on the presence and will be replaced by ex ante unconceivable new sets; anyway since Gödel we do know that - generally - recognisable opportunities or possibilities cannot be completely formalised.

Therefore, in contradiction to scholars following so called discovery theory (Alvarez 2005) it is her argued that a complete theory of opportunities is impossible at any time; the set of opportunities grows (Weizsäcker 1977). Here, it becomes evident that the stance of a truly changing world, with truly created entrepreneurial opportunities, automatically implies the allowance for time in such a model.

Inherently immanent to the concept of entrepreneurship is the term of novelty. Philosophically, in a realist approach something that is realised expresses itself to the actor and the scientist; such novelty can be grasped by formal models. Novelty is related to a given reality that can be formally depicted by a space of possible actions (Blaseio 1986). Therefore, it is possible to distinguish between subjective aspects like preferences and objective aspects such as possible actions (Ötsch 2007).

Assuming a relativist or subjectivist position, novelty cannot be identified interpersonally since tagging something as new is not an objective attribution, but dependent on the observer. Novelty becomes a category that is bound to the observer and subjective and objective components cannot be clearly dissected; it is an attribute that arises from a certain perception. This perception is dependent on individuals that dispose of an idiosyncratic set of extant knowledge categories, which allows them to classify something as new (Hesse 1990). This subjective cognitive effort is a creative act and related cognitive processes sources of innovation. As said, different individuals perceive an equal situation unequally, even if the same external stimuli hit their mind (Ötsch 2007). However, it will be the core of the present work to model such subjective cognitive processing that typically leads to novel outcomes in a given type of economic settings.

On a macroeconomic level, the subjectivist view that knowledge is idiosyncratic - note again that this is ontologically different from asymmetrically distributed as in a realist world - implies that economic agents build their own expectations based on different knowledge bases; therefore, it is this characteristic subjective nature of expectations that finally determines market processes (Koppl and Mongiovi 1998). These differences between subjects and their perceptions of identical situations built under uncertainty are the essence of entrepreneurship: being different (Casson 2003; Knight 1921). Please note that in a subjectivist conception decisions and expectations are not subject to risk but uncertainty since no probabilities can be calculated ex ante because inherent change and transformation cannot be predicted in a space of events (Alvarez 2005; Pendergast 2003; Shane 2003).

Again, it must be underlined that reasoning about novelty and corresponding models conceived within the framework of fallibilism, explicitly integrating creative agents, is accompanied by epistemological complications and it seems to be a prerequisite for research efforts to highlight, what can actually be captured if it seems that actually no general statement about individuals can be given.

A solution to the problem that humans systematically construct their own ideas is seen in networks of axiomatically independent theories that could be developed; this allows explaining a phenomenon by general (subject-independent) laws but nevertheless remained a singular event within the framework of another theory. This ontological insight justifies interdisciplinary research on primordial economic phenomena since the status of singularity in one theory leaves the status unaffected in another, if they are axiomatically independent of each other (Herrmann-Pillath 2001). This general insight can be applied to economic change; in this regard Witt (1993, 2001) refers to the argument that singular revelations of a change's content into a system make previously expected conditions, as in nomological-deductive models, irrelevant. Therefore, the nature of novelty implies that it's meaning and informational content, resulting in new states of the economic system, cannot be positively anticipated; but what can be defined are the conditions a novel solution must meet, disregarding the actual properties in this particular case (Witt 2001).

However, while it is admitted in the present work that it is impossible to escape this trap and it cannot be anticipated to which actual state or new configuration a system evolves, the author is deeply convinced that human thinking patterns that produce novel outcomes in a specific economic system are not themselves subject to change from a psychological point of view. Since in this psychological system of reference no singular phenomenon exists (Hermann-Pillath 2001), by taking a closer look to the field of psychology, the "[…] innovative environment […]" (Witt 2001, p. 51) for activities of the human mind that produce specific novelty in economic settings meeting specific properties can be studied by searching for laws.

Accordingly, it is no wonder that a variety of scholars has argued against the denial of creativity and time in economics for phenomena, in which evolution and change are dominant, reasoning that "[…] time is what brings new knowledge." (Shackle 1972, p. 151) In such "[…] new means are continually invented, new economic wants created, and new distributive rules introduced. The question is why a science interested in economic means, end, and distribution should dogmatically refuse to study also the process by which new economic means, new economic ends, and new economic relations are created." (Georgescu-Roegen 1971, p. 320)

Trying this, some economists embraced time by introducing historical moments that are not conceivable ex ante and represent singular, irrevocable events (Georgescu-Roegen 1971; Witt 2001). According to such a creative theory (Alvarez 2005) "[...] opportunities do not pre-exist

- either to be recognised or to be discovered. Instead they get created as the residual of a process that involves intense dynamic interaction and negotiation between stakeholders seeking to operationalise their (often vague and unformed) aspirations and values into concrete products, services and institutions that constitute the economy." (Sarasvathy et al. 2003, pp. 156-157) Consequently, it matters for the scientist when the object of study is observed, gearing research to economic agents, to human beings, and their originality or creativity (Witt 2001). It is this aspect that finally justifies including a relevant time dimension and not only referring to exclusive law-like regularities as in exact approaches (Blaseio 1986; Shackle 1972, 1979).

Consequently, some economists' approaches, e.g. in evolutionary economics, are based on the assumption that there do not exist invariant and universal laws, but these are evolutionary products and only temporarily valid (Dopfer 2001). Evidently, it is the explicit introduction of unprogrammable subjects that allows using terms like time, subject evolution, creativity, or novelty that turn out to be somehow synonymous in that the existence of one phenomenon implies the existence of the others (Blaseio 1986). Without digging to deep into the textual criticism of neoclassicism for neglecting subject and time, it is concluded here that turning away from the Robbinsian economic agent is mainly justified by the lack of neutrality of logistics and mathematics and the textual restrictions that the application of the formal method in modelling economic agents imposes; as Shackle put it: "Time and logic are alien to each other." (Shackle 1972, p. 255)

The temporal aspect has found particular entrance to evolutionary economics, which is quite palpable since explaining evolution and transformation is at the core of this strand. For the present work it is stated that formal models might promise insights regarding human action in stable systems, but hardly for creativity and true change (Blaseio 1986). Consequently, time is implicitly and explicitly considered as a relevant aspect in investigating entrepreneurial opportunities. Any description of entrepreneurial opportunities must include the aspect of path-dependency in the sense that there exist only few ways to capitalise on a venture idea, and the availability of these paths is constrained by time and space; it is therefore rather an evolving process of opportunity windows that open and close (Fiet et al. 2004b; Hougaard 2005); in other words, some opportunities do exist for years or decades, while others are strictly time-bound in a short period (Baron 2004).

In such a dynamic view, for instance considering business or technological cycles, the number of entrepreneurial opportunities varies (Bünstorf 2006; Murmann and Tushman 2001). It seems that along a technological cycle, entrepreneurial opportunities particularly emerge in phases before a particular technology becomes dominant and in phases of incremental change (Murmann and Tushman 2001). Embracing such a dynamic aspect in defining entrepreneurial opportunities underlines the importance of time in the context of entrepreneurship and opportunity recognition, which will be accounted for in developing a model of opportunity recognition in time.

In a work like the present, in which psychological insights are crucial, it seems to be of interest which position this discipline holds about the integration of time in theories on human action since these considerations are so closely intertwined with economic theorising they are presented here and not in the following chapter III on human thinking. Apparently, in the field of psychology time is of relevance; e.g. it is a common truism that the human mind evolves with the years and whole research streams are built on the developmental aspect (e.g. Harris and Butterworth 2002). However, on a basic cognitive level it could be asked how the human mind comes to a conscious image of time. Studies were able to show that the human mind has a kind of integrative mechanism that allows transforming physical stimulus into a subjective perception of time. This means that all stimuli entering the human mind within a given period of time are coordinated into a subjective simultaneity of events (Pöppel 1988). For the purpose of the present work - a work in the information processing paradigm (see chapter III.A.3) - it is not of interest, how this synchronisation is neuronally executed; it is rather relevant that such a neuronal mechanism provides the fundament for a feeling or subjective perception of time in the human mind. It results the proposition that events are temporally integrated into subjective representations of the presence that are updated every three seconds, as depicted in Figure 2 (Pöppel 1988).

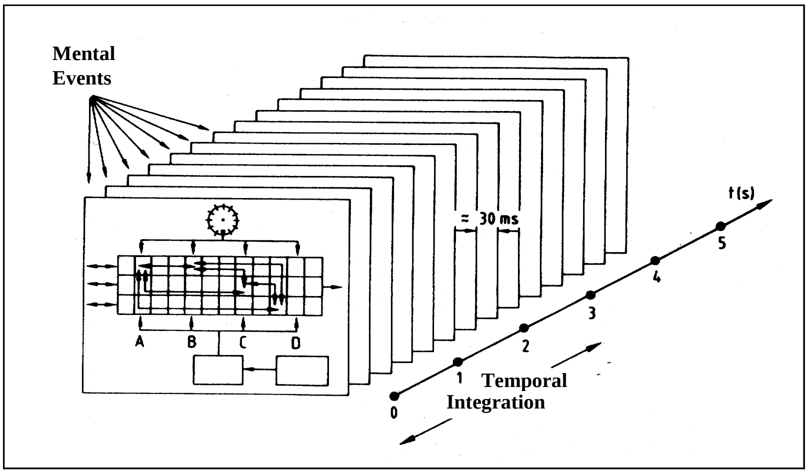

Figure 2 Temporal Integration of Consecutive Mental Events (Pöppel 1988).

Even though the frequency of updates is not of high importance in the present context it should be underlined that this does by no means imply that the human mind produces isolated representations. It is central to consider that human experience is characterised by time as a flow; i.e. the representations are linked with each other and the content of one representation always determines the content of the following. Hence, this linkage is the reason why we do not realise that our conscious presence is only limited to a few seconds since for our understanding of the world contents are decisive; therefore, the formal temporal isolation of the representations itself is not content of our consciousness and therefore not relevant.

Summarising this, it can be stated that semantic linkages between contents of the single subjective representations lead to a continuous perception of our own perceptive capabilities (Pöppel 1985, 1988). In an economic context the temporal aspect has found particular entrance to evolutionary economics. This is not a matter of course since many neoclassical microeconomic models allow for only one decision or action in time (e.g. Debreu 1959), defining human behaviour for an infinite number of periods.

Following the above mentioned arguments, in the present work a certain discrete action at a certain point in time (t_n) is based on previous decisions and actions (in t_{n-m}) and has implications for following decisions and actions (in t_{n+m}) (see all the literature on paths and path dependency in evolutionary economics; see for an overview Lundvall 1992; Muller 2001). The cognitive processes that are central in modelling economic thinking are the semantic linkages that guide the changes in the mental representations.

Given the subjective nature of economic agents in general, it must be asked how economists went about to model the entrepreneur as such an individual introducing novelty into economic systems? Consequently, following part of this chapter introduces the most influential conceptualisations.

B. Entrepreneurship

1. Entrepreneurs: Humans that Introduce Novelty to Economics

However, even if it is often agreed on the general importance of subjectivism in relevant theories, research streams such as Austrian economics are rather heterogeneous concerning this issue. Particularly concerning an economic agent's reasoning the differences that are subsumed under the term of subjectivity are significant. Some approaches that might be tagged or intended to be in a subjectivist tradition might still remain in a principally realistic model of the world with humans conceivable as automatons. Concerning the introduction of novelty into economic systems mainly two approaches should be mentioned, which were asserted by Hayek as well as Kirzner on the one hand and Lachmann on the other (Sarasvathy et al. 2003). Between these two main approaches to an individual's creativity "[…] the cleavage lies in the exclusion of the creative dimension of the human mind from the Kirzner-Hayek conception: by contrast with Lachmann's view, agents are limited to discovery, discovery of profit opportunities and discovery of knowledge." (Gloria-Palermo 1999, p. 62)

In the former notion of the market process, agents do not initially possess more knowledge, but the existence of profit opportunities creates incentives to discover new knowledge. Therefore, the actual entrepreneurial activity lies in the exploitation of opportunities, which have emerged through market insufficiencies. By exploiting these, new knowledge diffuses in the market, transforming the entrepreneurial action into an equilibrating act (Shane 2003).

Again, the Hayekian and Kirznerian approach to the market process differ in that the former does not believe in an "[…] immutable reality that is out there and waiting to be discovered once and for all." (Gloria-Palermo 1999, p. 66) Hayek rather assumes that the world is in continuous change and unexpected deviances result of changes in exogenous variables; thus, inferring that there can never a long-term equilibrium exist (Hayek 1945). It should be evident that such a conception is somehow closer to a relativist conception of the world in the sense that the ubiquitous construction of reality ontologically precludes a state of equilibrium. However, both Hayek and Kirzner, attribute a discovering function to the individual, which does not require creativity for finding entrepreneurial opportunities.

Lachmann's concept strongly differs in this point from the above presented notions: while in these an agent's plans are regarded as a subjective interpretation of past experience, Lachmann introduced a creative dimension (Lachmann 1969). He argues that through the interaction of knowledge - as a symptom of any economic situation through its interpretation in the context of past experience - and expectations as the interpretation of the future situation - are created through imagination, totally representing a constructivist stance and allowing for the investigations that are intended to be carried out in the present work (Lachmann 1969).

In summary, it can be said that although the importance of entrepreneurial individuals is uncontroversial within Austrian economics, the entrepreneur is attributed a different role in the different strands of this research stream and in economic theory in general; a controversy, which can be traced back to their ontological fundament. Apparently, these notions also differ as to the explanations for situations, in which individuals are able to recognise entrepreneurial opportunities (Ripsas 1998).

The two most prominent approaches concerning this issue and somehow representing the two fundamentally different ontological views treated here, are named after the authors, who mainly shaped the concepts: Kirzner and Schumpeter (Sarasvathy 2004; Yu 2001). The main disagreement is seen in the role of information for the existence of entrepreneurial opportunities and the corresponding ontological consequences: Kirzner claims that a differential access to existent, therefore somehow objective, information is sufficient to identify opportunities, while Schumpeter was convinced that new, and therefore subjectively created, information is necessary for the alert individual to identify an entrepreneurial opportunity. Thus, two modes of entrepreneurship can be differentiated: the Kirznerian rather being imitative and equilibrating and the Schumpeterian innovative and destructive or disequilibrative opportunities (Yu 2001).

Ontologically, Kirzner assumed a given stock of opportunities that is principally of a finite nature and sees the role of economic agents in overcoming shortcomings in the discovery of such entrepreneurial opportunities (see also Boland 1978), while Schumpeter emphasises the constructive force of humans that results in endogenous change and a principally infinite number of opportunities. Conceptually, it could be concluded that Kirzner builds his concept on humans' incapabilities and Schumpeter on their capabilities (Blaseio 1986).

In some more detail, Kirzner built his concept of entrepreneurship upon the fundament laid by Mises' human action theory (Yu 2001). In a nutshell, Kirzner argues that individuals use existent information to come to an expectation about efficient resource combinations. However since his economic agents act in a world of imperfect knowledge, they consequently construe imperfect expectations or beliefs and commit mistakes in allocating resources, somehow in a sense of bounded rationality (Kirzner 1973). If an individual subjectively designs a more efficient expectation, it hopes to make a profit from it. Therefore, Kirzner regards imperfect knowledge of market participants as the main source for entrepreneurial opportunities. Principally, each individual who is first to detect is able to grasp them. At the same time, this process of making profit represents a process of eliminating imperfect market knowledge or reducing the boundaries on rationality (Kirzner 1978). Since imperfection of markets is reduced, entrepreneurial activity has equilibrating effects. This does not imply that

Kirzner assumed an economy would ever reach the state of equilibrium (Kirzner 1999). However, this broad view of the equilibrating entrepreneur**,** consequently, includes arbitrage activities since they are also equilibrating (White 1976).

Central to his approach and his explication of change in markets is the described alertness of entrepreneurial individuals that allows making discoveries that are valuable in the satisfaction of human wants or needs (Alvarez 2005; Yu 2001). Kirzner himself defines entrepreneurial alertness "[…] as an attitude of receptiveness to available, but hitherto overlooked opportunities." (Kirzner 1997, p. 72) This means that entrepreneurs have a superior or more accurate perception for objective signals in the external world.[iii] Accordingly, it is not the mere possession of knowledge that explains entrepreneurship, but an individual's ability to find relevant market data.[iv] Emphasis is put on the process of discovery of relevant information and not information itself (Kirzner 1973).

In some more detail, the alertness to an opportunity is contingent on two main factors: (1) The attractiveness of the perceived opportunity, and (2) its ability to be grasped (Kirzner 1979). Initially, Kirzner alleged a rather passive view of opportunities as being 'ready' out there, neglecting an entrepreneur's creativity, who rather stumbles over them:[v] "He is alert, waiting, continually receptive to something that may turn up […]." (Kirzner 1979, p. 7) This also implied that individuals do not actively search for opportunities, but are rather hit or surprised by a hitherto oversee opportunity (Sarasvathy et al. 2003; Yu 2001).

In contrast to Kirzner's somehow realism-based conception of the world, Schumpeter argued that new information is used by specific individuals, the entrepreneurs, to develop new combinations of productive goods (Schumpeter 1934). Therefore, his view on entrepreneurial activity is not necessarily based on imperfect information in markets, but on newly generated information available to the innovative individual at hand. It should be apparent by now, where the principal ontological difference between these conceptions lies: subjective individuals can always generate new information idiosyncratically by construing their own reality. Such innovations can be (*1*) the introduction of a new good - that is one with which consumers are not yet familiar - or of a new quality of a good. (*2*) The introduction of a new method of production […]. (*3*) The opening of a new market that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before. (*4*) The conquest of a new source of supply of raw materials or half-manufactured goods […]. (*5*) The carrying out of the new organisation of any industry […]." (Schumpeter 1934, p. 66; *enumeration added*) The types of innovation named by Schumpeter already show that in his conception the entrepreneur is a rather disequilibrative force, not simply by keeping an economy grow, but by changing the whole course or trajectory of doing something itself by construing genuinely new ways (Schumpeter 1934).

Interestingly, after being criticised for the exclusion of the creative element (see for instance White 1976), Kirzner refined his approach and accepted the view that there also exist situations, in which creative imagination is applied by individuals to shape the future (Kirzner 1982). He did that mainly by introducing the distinction between single-period and multi-period markets, admitting that for the latter imagination can be of some significance (Kirzner 1982). Important in the context of the present work is that Kirzner (1999) himself admitted that for the understanding of the psychological profile, which characterises the real-world entrepreneur, the Schumpeterian entrepreneur is more valid and accurate.

However, although the views seem on the contrary from an ontological perspective, the literature nowadays often ignores such basic differences and alleges a pluralistic view, not considering the Schumpeterian and Kirznerian view as concurring conceptions for the same phenomenon. It is argued that they rather describe two different types of entrepreneurial opportunities (Shane and Venkatamaran 2000). While Schumpeterian opportunities result from forces that are triggered off by market disequilibria, Kirznerian opportunities rather emerge through routine activities and imitation. As already mentioned, this has equilibrating effects and brings the economy closer to its economic equilibrium (Yu 2001). Put briefly, the latter actions reinforce established processes, while the former change the existing system radically (Gloria-Palermo 1998).

2. Economic Human Action in Time

In the present work it is assumed that such a progress can be achieved by approaches explicitly integrating cognitive factors since not only modern psychologists but also social scientists and economists agree on the particular importance of cognitive factors for human behaviour (Blaseio 1986). Such insights are explicitly considered in theories of problem-solving, which were introduced in economic settings by Popper (1959), and are incompatible with the utilitarian tradition (Hesse 1990). Perhaps the most importance difference lies in that problem-solving approaches explicitly allow for context (Granovetter 1985; Esser 2003), which is typical for cognitive approaches as will be pointed out in chapter II.A.2. This dependence of human behaviour on time and space it is embedded in has, if considered, massive impacts on what microeconomic models must consider (Albert 2005). Hereafter, Hesse's (1990) model of human action in time is introduced that integrates the ontological stance of the present work; by doing so, it should become evident, how the introduction of cognitive constructivism alters the fundamentals of theorising about economic agent's behaviour. What does this actually imply for the present work and all economic research that regards human behaviour as the basic analytical element of its ontology? First and foremost, models used in such approaches to describe human behaviour must explicitly embrace creativity. However, it still remains the challenging task to determine what in the world can be thought of as machine and what as creative element. Hereafter, a model of human action in time is presented that seems to be in accordance with all the arguments mentioned so far, and functions as the fundament for the model of opportunity identification to be developed in the present work.

Based on a deductive-nomological model, like they have been most popular in mainstream economics for a long time, Hesse (1990) has developed a model of human action in time that explicitly considers creativity of the human mind. The general question is how action in time can be seen and modelled? Based on methodological individualism, only humans are considered as actors in this approach, thereby, excluding any direct role of constructed forces like history, evolution, or capital. However, first of all it will be shown how a mechanistic model of human action typically explains the outcome (of the human act) as logical from the situation the human being is situated in. This provides a framework for the subsequent integration of the creative element. Basically, mechanistic models are developed like deductive-nomological explanations: such consist of at least one universal condition alleging that at each point in time and space specified consequences occur if certain conditions prevail. These two elements (the explanan) lay the ground for logical deductions of the phenomena (the eplanandum); here human action (see column 1 Figure 3).

Consider a model of human agency that distinguishes two broad types of actions: (1) reflexes, e.g. stimulus-reaction, or actions in affect, and (2) reflected action. These two differ conceptually in that the latter kind of action involves conscious reflection or verbalisation about conditions and options of choice of the particular situation at hand. This means in other words that the latter includes a significantly higher degree of intentionality (Pöppel 1988; Searle 1983). Since only reflected action seems to be relevant to the present work (it can be assumed that the choice of recombining resources or finding and exploiting entrepreneurial opportunities represents a reflected action, consciously elaborated on by the individual), only such types of action will be considered in the following (Hesse 1990). If such human action is to be explained, neoclassical models base on the principle of rationality as nomological hypothesis. This represents the linkage between observable action and mental operations of the situational constitution and the order of choices. At this stage, rationality only means that the choice, which has been identified to be the best, has actually been chosen and executed.

I	II	III
Deductive-nomological Explanation: General Form	**Explanation of Reflected Human Action by Situational Logic**	**Independent Variables in Explaining Observable Action**
Conditions $(A_1 ... A_n)$	A_1 : Situational Constitution (Description of Options)	Knowledge, Heuristics; Economic Capacity
	A_2 : Order of options	Objectives; Rules of Ordering
Nomological Hypotheses $(NH_1 ... NH_n)$	NH_1 : Principle of Rationality	
Explanandum	Action (e.g. H_1)	

Figure 3 Situational logic (based on Hesse 1990, p. 58).

However, before the principle of rationality can be applied, the available choices must be evaluated and put into a hierarchical order. This problem of ordering alternatives is subject of constraint-choices approaches and can be solved mathematically by optimisation techniques (see column 2 Figure 3) (see e.g. Eisenführ and Weber 1999). With such a view on human decision making the principle of causality can be kept, which is methodologically convenient since the same relevant conditions always lead to the same result (Blaseio 1986). So far, this model is ontologically quite similar to neoclassical approaches and the human could be programmed as an automaton. The central cleavage lies in the perception of the conditions in a situation: This perception and resulting available options are contingent on an individual’s idiosyncratic knowledge about events and objects, its heuristics about correlations and effects, and its economic capacity (see column 3 in Figure 3). Accordingly, it is simple unrealistic to assume that similar conditions are given for different individuals, independent of any complexity of the situation at hand; consequently, pure deductive-nomological models are not fruitful in explaining human action (Coulter 1996). This resembles to the general principle of irreversibility states that dynamic development cannot be rescinded by an inversely directed development and, therefore, there a world with exactly the same conditions only exists once (Schrödinger 1967).

Some may argue that modern neoclassical microeconomics and their subjective utilitarism, have abandoned the homo oeconomicus and are exactly assuming this view. However, ontologically there exists a difference: the present model does not claim that the subjective and objective situations correspond or certain mathematical rules for ordering options are applied. Therefore, it cannot be justified to infer bounded or limited rationality, if humans in real situations do not apply the definitions of a situation or rules of ordering that economic researchers regard as correct. In such a view there is no such thing as bounded rationality since it is ontologically assumed that the situation subjectively 'is' as the individual at hand perceives, and that another subject (the researcher) cannot claim to know or perceive the 'real' conditions of a situation (Hesse 1990). If such objective conditions could be defined, the application of a nomological-deductive model for human action in time would be rather simple and correspond to the one outlined above. However, it is the main argument alleged here that this is ontologically impossible: Central reason is that the mental situation imposing the conditions for subsequent processes results from an idiosyncratic construction by the individual.

In summary, the classical microeconomic base unit of human action is consequently expanded, adding to the principle of rationality the principle of cognitive creation (Esser 2003; Shackle 1972). This means that the task of economic agents is no longer simply allocation in a given framework of means and ends, but also the construction of idiosyncratic means-ends frameworks. This principle of creativity or creative cognition is what accounts for the systematically 'false' construction of means-ends frameworks of economic agents, i.e. the principal impossibility to establish universal and true statements about the world, that characterises fallibilistic approaches like the present (Herrmann-Pillath 2001). It also follows from the constructivist stance that the exact microeconomic approach, which only allows for allocation problems, does not describe a well-defined number of situations, but simply neglects an essential aspect of each economic situation (Hesse 1990). Here, it is even alleged that it is such an expanded view on human action or choice that allows for introducing novelty in economic systems: "Economic choice does not consist in comparing the items in a list, known to be complete, of given fully specified rival and certainly attainable results. It consists in first creating, by conjecture and reasoned imagination on the basis of mere suggestions offered by visible or recorded circumstance, the things on which hope can be fixed." (Shackle 1972, p. 96)

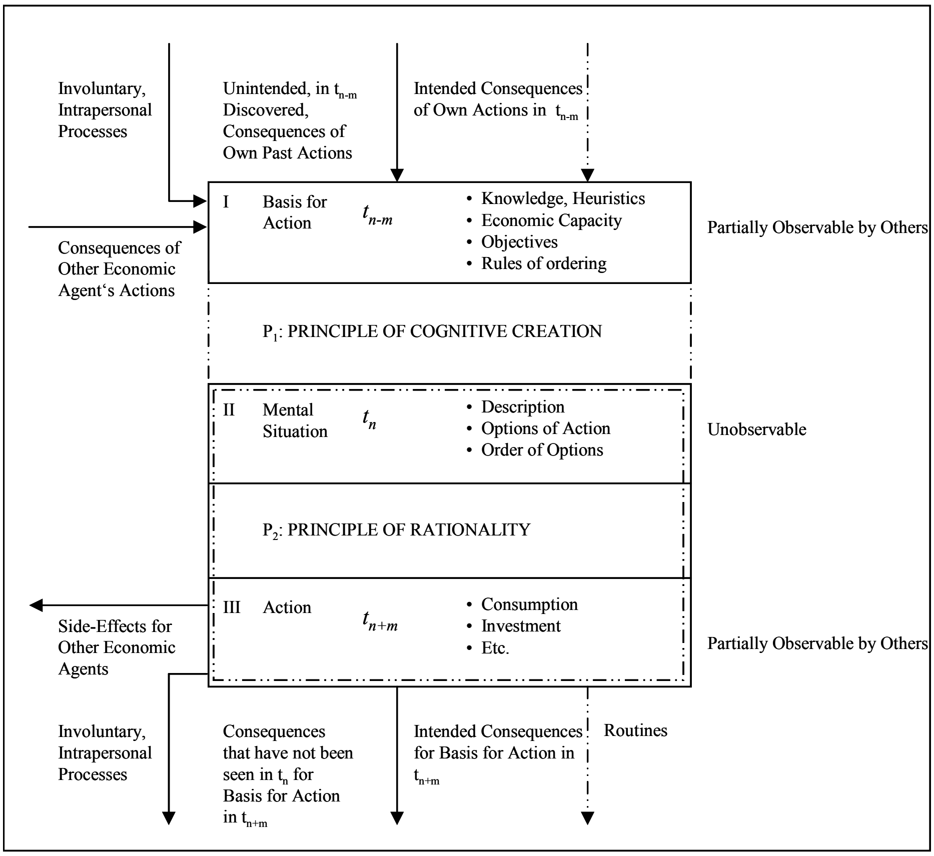

Figure 4 Human Action in Time (Hesse 1990).

Figure 4 depicts a model of human action in time that is built up on the constructivist ontological stance outlined above and expands the typical microeconomic model. As already indicated, the model identifies a certain discrete action in t_n that is based on actions in t_{n-m} and has implications for t_{n+m}. Therefore, actions in time result from discrete creative acts. This leads to a particular configuration containing personal knowledge, heuristics, economic capacity, objectives, and rules of ordering at each point in time. This partially observable configuration of an economic agent's mind is not the basis providing the conditions for the principle of rationality as the nomological hypothesis. Rather, the human mind subjectively transforms these into an unobservable mental situation, containing a personal description of the situation, options of actions, and rules for ordering them. This process of coming to such a mental situation is named the process of cognitive creation, which can be seen as a principle, how an individual transforms the initial base of action into an idiosyncratic mental situation (Hesse 1990).

The application of the principle of rationality on such subjective mental situations leads again to the partially observable action; however, this is not the core topic of the present work since it rather resembles to the decision to act upon an entrepreneurial opportunity in the entrepreneurial process, and is therefore neglected here. It is more important to take a look into the literature of cognitive psychology to see, whether the principle of cognitive creation cannot be modelled in some more detail, thereby not directly moving the borders of what can be described by exact methods but at least being more precise about the principle of cognitive creation in economic settings.

The present work is an attempt to enter the residual concept of creativity, the bounded uncertainty (Shackle 1972) in economic settings that has often been named as the source of novelty and change, but remains a scientifically untouched construct (Blaseio 1986). However, what some economists regard as a central insight, that "[…] novelty is the transformation of existing knowledge, its reinterpretation; in some degree necessarily its denial and refutation […]" (Shackle 1972, p. 56), is uncontroversial in cognitive psychology and has already been modelled and investigated for a long period. In fact, the basic ideas of such models that novelty in economic systems, in which uncertainty prevails, cannot be modelled with nomological-deductive models for many realistic situations gain more and more acceptance.

For instance, Sarasvathy (2001) argues that in many situations it is not the goal or end that is given, but a set of means, for which economic agents conceive a set of potential ends of which one is selected as being worth to be pursued (Mitchell et al. 2007). She distinguishes between two types of decision situations; the classical decision making situation in which a given goal is intended to be achieved in well structured and specific situation, by choosing between a set of alternative means or cause available at the moment of the decision is called a causation-dominated decision process. Such models resemble to the ones that have been described as insufficient to account for entrepreneurial behaviour since it is impossible to describe constraints on possible means and the criteria for selecting between them. Therefore, decisions involving effectuation are proposed that differ in that they start with a given set of means and very general aspirations of the individual at hand, which are not explicit but rather a set of possible effects. For these, economic agents develop subjective constraints and criteria for selecting between them (Sarsvathy 2001).

Summarising what has been said so far, entrepreneurship is the introduction of novelty into economic systems. It is a process that is highly influenced by mental aspects, here named opportunity identification. Consequently, accounting for cognitive constructivism, the present work is an attempt to base an agent-based model of entrepreneurial discovery on a post-modernist fundament in a double sense: the model is based on a relativist or subjectivist fundament, modelling the economic agent in such terms and regards economic systems as such systems that are marked by their inner coherency and pragmatic usability (Lakatos 1970; Popper 1935; see for more details chapter III.A.3). While the former refers to the argument that economic agents come to different hypotheses about future situations, i.e. making Popperian conjectures (Hamilton and Harper 1994; Meyer 2000), the latter is particularly important in this context since it makes change and subjectivism inherent phenomena of economic analysis. This means that inter-subjectivity, i.e. the agreement of individuals on a statement, replaces any objective nature of statements. Further, assuming a constructivist ontological perspective, a model of human action must explicitly consider human cognition and creativity; thus, thinking and cognition are central topics in this issue. This is the reason why, after discussing the conceptualisation of entrepreneurial behaviour more thoroughly in the next paragraphs, chapter II will take a closer look at the way creative thinking can modelled in contemporary psychology.

3. Entrepreneurship: The Process of Introducing Novelty to Economic Systems

Entrepreneurial activity of economic agents has played a significant role in explaining economic growth and job creation and recently many attempts were made by governments to promote it (Ko 2004). It is argued that certain economic agents are responsible for changes in economic structures and, thus, are the most important engines of economic growth (Baron 1998; Hayek 1945; Timmons 1990b). Most generally, entrepreneurship occurs when an economic agent notices and acts respectively recognises and exploits a profit opportunity (Eckhardt and Shane 2003; Venkatamaran 1979). The central elements of such a notion of entrepreneurship are the entrepreneurial individual and the entrepreneurial opportunity to act upon. Nevertheless, for a long time mainstream economic theory has neglected the importance of entrepreneurship: most of the dominating equilibrium models in economics regard all profit opportunities as already exploited (Holcombe 2003). This assumption denies the agreed-upon fact that, although economic forces pull the economy towards equilibrium, this is a moving target that is never reached (Holcombe 2003).

Historically, the concept of entrepreneurship and entrepreneurial opportunities is often related to a particular research strand in economics: Austrian economics. During the last decades modern Austrian economics has emerged out of the classical subjectivist tradition (see Buchanan 1982; Coats 1983; Lachmann 1982); it is also called Austrian market process theory and is related to neoclassical economics, but aims at building upon more realistic conjectures. Despite the heterogeneity of Austrian economics (Gloria-Palermo 1999), an attempt to summarise these fundamental assumptions or constitutional characteristics might name methodological individualism, general uncertainty and real time, subjectivism, dynamic market process theory instead of static equilibrium theory, invisible-hand-explanations, and deductive methodology (Budzinksi 2000; Kirzner 1992). Perhaps most notable about Austrian economics for the context of the present work is its view on individuals: Most approaches in this research stream bring economic agents to the fore and aim at integrating subjective human behaviour. It is the main objective of Austrian economists to explain change in economic systems endogenously and, therefore, regarding dynamic market processes triggered off by entrepreneurial individuals and their decisions (Röpke 1977).

Opposed to this, in the prevailing neoclassical paradigm the economic analysis of individual decision making is found in its economic aspect. This has been understood in terms of the allocation of scarce means among competing ends; that is rational decision making (Robbins 1932). This particular conception of economising or maximising individual economic agents resulted in the idea of the market as built up by a multitude of economising individuals, of which each takes his decisions with according to a given series of ends and means (Kirzner 1973). Such a view became the dominant research paradigm in economics in the 1930s and 1940s, ending a period of pluralism in the way economic phenomena were approached. Neoclassical economics was based on the idea of economic equilibriums, originating in physics and mechanistic metaphysics and had almost suppressed the historical, non-mechanistic metaphysical approach to economics that was widely spread in strands, such as the Scottish school, the German historical school and the American (Venablian) institutionalist school (Dopfer 2001).

Neoclassical models assume perfect competition in markets, which means that every economic agent has perfect knowledge about all economic opportunities; apparently, this notion leads to main difficulties in explaining entrepreneurial behaviour since in case perfect competition prevails the price mechanisms of a market are incapable of guiding an agent’s decision to exploit an entrepreneurial opportunity or not. In some more detail, mainstream economists assume that a price contains all information of all market participants, necessary for allocating resources. This implies that the allocation of resources is a rather mechanistic decision process of mathematical nature, which can be rationally derived by the complete information given. Market equilibrium is reached by the optimisation of information contained in the price; this is through selling if prices increase and, vice versa, purchase if prices decrease. Is the market in equilibrium, that is a pareto-optimal state in which no gains from trade exist (Eckhardt and Shane 2003), agents have no reason to change their selling and purchasing behaviour since no allocation represents a superior alternative (Hayek 1945).

However, an entrepreneur aims at combining resources in a new manner to gain a profit. This means that he does not solve an optimisation problem in known means-ends frameworks, but faces a non-optimisation task through the implementation of new means-ends frameworks (Shane 2003). A "[…] means-ends framework is a way of thinking about the relationship between actions and outcomes." (Shane 2003, p. 40) Economic agents build expectations about the profitability of different resource combinations, thereby creating new means-ends frameworks: Based on these, the economic agent has to take decisions about the use of resources; however, as already indicated, the price cannot support the decision since information about a new good's price (or more general: a new resource combination) is not available until the good has not been introduced into the market. Put differently, the price cannot tell the agent if he can make a profit with the new resource combination since he cannot calculate the earnings and compare them with the costs. "Therefore, prices and revenues for new products cannot determine the resource allocation decisions of the entrepreneur that lead her to acquire the resources to develop a new product." (Shane 2003, p. 57) Entrepreneurial decisions cannot be optimisation decisions and, therefore, cannot be based on market prices since optimisation is based on known prices and quantities, but these do not exist for future moments in time, for which economic agents must build expectations (Eckhardt and Shane 2003; O'Driscoll and Rizzo 1985); the result is that uncertainty prevails (Knight 1921).

Because an economic agent's expectations are subject to uncertainty, the opportunity to realise an entrepreneurial profit arises: this could be defined by the difference expected between the ex-post value of a resource combination and the ex-ante costs for acquiring the necessary resource and their recombination (Rumelt 1987). Uncertainty represents a precondition for this profit because only given this condition the current owner of resources is willing to sell them to the entrepreneur at a price that allows the latter to realise a profit. If certainty prevailed, the owner would know the recombined resources' value and would sell them for a higher price riding away the profit opportunity. In summary, uncertainty gives the entrepreneur the chance to come to a superior assessment of resource combinations and their value, consequently allowing him to buy them at a lower price than he can sell them (Shane 2003).

However, as has been shown, there are different ways of interpreting this subjective element in economic behaviour and the nature of knowledge and information ontologically, which has important influences on the modelling of human agents in economic situations. However, independent of the reasons why this is the case, it is central to entrepreneurial activity that individuals expect a profit from buying, selling or transformating resources: the entrepreneur perceives a new means-ends framework (Eckhardt and Shane 2003). Therefore, a means-ends framework could be simply seen as an individual expectation about the value of resources. These are different since the price does not contain all information and information is dispersed, which converts individual knowledge into one of the central aspects of economic behaviour. Such a framework is fundamental to entrepreneurial decisions since it indicates entrepreneurs that prices do not accurately represent the value of products or services; a situation, of which the entrepreneur is convinced that it can be altered by a superior resource allocation, implying the gain of profit through selling the output of the new resource combination (Casson 2003).

In fact, irrespective of the ontological stance, it is an undisputed insight that knowledge is not given to anyone in totality, an argument which is usually attributed to Hayek (1945), who asserted that the fundamental economic problem is not the allocation of resources but instead a problem of dispersion of knowledge and utilisation of information (Holcombe 2003). Hayek postulated the concept of dispersed knowledge in an economy, which was fundamental for the concept of entrepreneurial opportunities. He distinguished between two types of knowledge: (1) scientific knowledge (in the sense of general rules) held by experts, which he assumed to be overrated in its importance for economics, and (2) the knowledge of the particular circumstances of time and place. Hayek pointed out that practically every individual possesses some advantage over all others since it disposes of unique information of which beneficial use might be made (Sarasvathy et al. 2003).[vi]

In many or even most cases, such knowledge is not easily transferable to others. Certain knowledge, for instance in form of abilities, can be acquired by experience, but is difficult to articulate to others. In consequence, entrepreneurial opportunities of a specific type will be available to some economic agents, but not to others; expressing the important role that knowledge plays for the recognition or construction of entrepreneurial opportunities. This argument has led to a variety of research in entrepreneurship focussing on the differences in prior knowledge as a central aspect of entrepreneurial opportunities and the process of entrepreneurship (see Shane 2000 and chapter IV.A.3). In summary, the notion of dispersed knowledge has two fundamental implications for understanding entrepreneurship and the concept of entrepreneurial opportunities: firstly, dispersed knowledge implies uncertainty or ambiguity, which gives rise to opportunities. Secondly, dispersed knowledge is an explanation for the notion of a nexus between entrepreneurial individuals and a particular opportunity, through which new markets are discovered, created, and exploited (Shane 2003).

What all these scholars dealing with such topics implicitly or explicitly claim is that investigating these processes by focussing on specific economic actors can significantly contribute to an understanding of economic phenomena; in one form or another it is the subjective human behaviour that accounts for many phenomena in economic systems. Many economists in such strands as Austrian economics or evolutionary economics conceptualised their notion of market process and economic interaction on the conjecture of economic behaviour under uncertainty, converting it into one of the central topics in economic research (Sarasvathy et al. 2003). Their approaches include a broader notion of human action (Mises 1949).

For instance, Mises's human-action concept, unlike that of allocation and economising, does not restrain the decision making individual (or the economic analysis of these decisions) to a framework of given ends and means. In this concept of human action, the actions of individuals intend to remove uneasiness and to make themselves better off (Kirzner 1973). This notion is broader than economising since it does not constrain the analysis of the decision to the allocation problem posed by the juxtaposition of scarce means and multiple ends, assuming a rather mechanical computation of the solution to the maximisation problem, implicitly posed by the configuration of the given ends and means (Kirzner 1973). Instead much more emphasis is put on the subjective perception of the ends-mean framework within which allocation and economising is to take place.

Another extremely influential scholar emphasising the role of cognition for economic agents' decision making and, thus, of the individual was Hayek, who developed the concept of the human mind as a movement pattern detector (Hayek 1967). He assumed that individuals dispose of patterns with which they reduce the complexity of their environment. The patterns were built during previous situations. Perception or economic thinking is therefore modelled as a process of classifying perceived stimuli into extant concepts or schemas; these processes of understanding the world inherently and inextricably include an interpretative element: Perception, thinking, and behaviour are therefore highly idiosyncratic and only explicable considering an individuals experiences (Hayek 1967). It will become apparent in chapter III, how modern this conception of human thinking is and how strongly it resembles to contemporary models of human thinking (North 1999); also similar to the general conception of human thinking used in the present work, which becomes particularly visible by considering the role attributed to the information-process of category selection.

Considering the importance that is attributed to the subjective element, it somehow appears a methodological necessity to start with the individual. And indeed, methodological individualism is regarded as one of the fundamental characteristics of research in Austrian Economics for instance (see Hodgson 1988; Udehn 2001; Winter 1993). However since the present work does not benefit from an in-depth discussion of individualism it should be satisfactory to state: “The key element in classical statement of methodological individualism is a refusal to examine the institutional or other forces which are involved in the moulding of individual preferences and purposes.” (Hodgson 1986, p. 211) This means that theories adhering to it begin with the individual as methodological starting point for all explanations and inferences of economic phenomena. Thus, human behaviour is seen as active, creative and human instead of passive, automatic, and mechanistic as in the neoclassical paradigm (Kirzner 1978; O’Driscoll and Rizzo 1985).

This individualism is based on the assumption that all social processes can be explained best on the basis of individual behaviour. Consequently, “although in modern economics, collections of individuals are sometimes treated as ‚entities’ for analytical purposes […] the ultimate unit of analysis is always the individual; more aggregative analysis must be regarded as only provisionally legitimate. In other words, the economist is always sensitive to the possibility that the holistic treatment of groups of individuals may mislead greatly, or involve overlooking dimension of reality that are extremely important.” (Brennan and Tullock 1982, p. 225) This corresponds to Popper’s conviction that collective phenomena can be tracked back to individuals (Popper 1987). Accordingly, methodological individualism claims that research should not pay primary attention to organisations or collectives; rather, theories about social phenomena should start with the views and behaviours of individuals since without their actions the phenomena would not even become evident (Richter and Furubotn 2003).

Hence, since largely based on Austrian economics, most entrepreneurship research brings the individual to the fore (e.g. Baum 2003; Baum et al. 2003; Baumnol 1993), in particular those efforts focusing on the aspect of opportunity identification (e.g. Shane 2003; Shane and Venkatamaran 2000; Lumpkin et al. 2001). The indicated importance of methodological individualism for research in this discipline becomes apparent in a recent definition of entrepreneurship as the field which deals with "[…] individuals who create opportunities where others do not, and who attempt to exploit those opportunities through various modes of organising, without regard to resources currently controlled." (Mitchell et al. 2002, p. 96) Despite its indisputable value for research, methodological individualism causes problems if interactive processes are regarded to be crucial: "As much care was taken in uncovering the different economic roles that might be combined in ‚the entrepreneur' as in discussing the problems that arise if the roles are divided among many individuals." (Winter 1993, p. 182)

Despite possible shortcomings of methodological individualism, an increasing number of researchers started bringing together the disciplines of psychology, of which many are individualistic, and economics; it is argued that both fields aim at explaining human behaviour and social phenomena from the perspective of the actor himself (Yu 2001). Thus, research on entrepreneurship has a multidisciplinary tradition and bases its theoretical models in a rather eclectically manner on insights of various disciplines, such as economics, sociology, psychology or strategic research (MacMillan and Katz 1992; Mitchell et al. 2002, 2004). The reason - as already shown - is simply that "[…] entrepreneurial behaviour can not be explained by economic theory alone because psychological, cultural, and sociological factors are important, too." (Ripsas 1998, p. 110) After briefly introducing the main characteristics of the fundament on which many research efforts on entrepreneurship are built upon, hereafter a general theory of entrepreneurship is outlined that seems to meet the claims for integrating the individual and the opportunity, as well as an interdisciplinary nature of the phenomenon in explaining entrepreneurial behaviour.

The general notion of an entrepreneurial element in economic systems led to the development of concepts designed to model the entrepreneurial process. As already hinted at, entrepreneurship can be seen as the process that includes all the acts an individual or economic agent executes to take advantage of a profit opportunity that is present in the economy (Holcombe 2003). Put differently, "[…] entrepreneurship is about individuals who create opportunities where others do not, and who attempt to exploit those opportunities through various modes of organising, without regard to resources currently controlled.“ (Mitchell et al. 2002, p. 96) The two main process-based elements of such a notion of entrepreneurship are the identification and exploitation of entrepreneurial opportunities by individuals.

A currently popular general model, outlining the entrepreneurial process, is Shane’s (2003) general theory of entrepreneurship; it is characterised by the conjecture that a focus on the individual is important but, nevertheless, insufficient to explain the whole phenomenon. Rather the central point is the nexus between entrepreneurial individual and the entrepreneurial opportunity, corresponding to the notion of the present work.[vii] In this model, the economy is subject to continuous change and disequilibrium. This gives rise to situations, in which individuals can recombine existent resources, thereby bringing them into a new form, of which they are convinced it yields a profit by increased income exceeding the cost for creating the new form. Here, the entrepreneur is the alert individual that recognises the existence of such opportunities and, based on this, develops a business idea to exploit it. This includes a marketable product or service, which is offered to other economic agents (opportunity identification). Having this idea, the entrepreneur obtains the necessary resources, designs an appropriate organisation or other possibilities of exploiting the opportunity, as well as a strategy to realise it (opportunity exploitation). The model considers a set of factors on the individual, the industry, and the institutional level that influence the central activities in the entrepreneurial process. In the context of the present work it seems noteworthy that Shane explicitly suggests an interdisciplinary approach to the phenomenon, integrating economic, psychological, and sociological theories (Shane 2003).

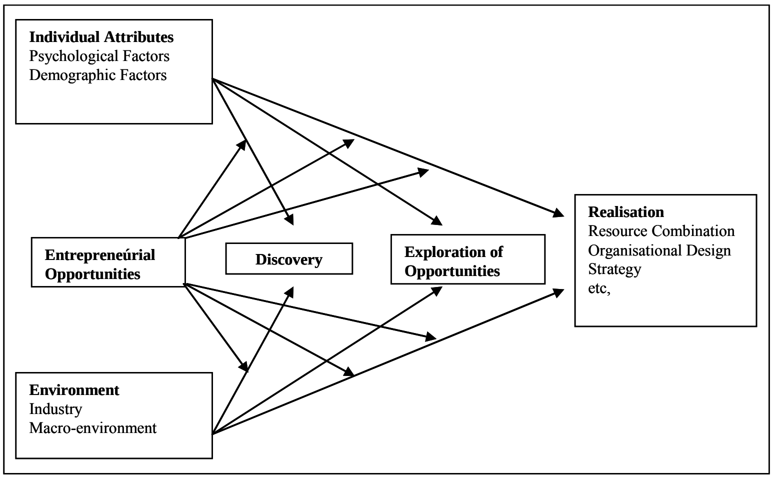

Figure 5 The Entrepreneurial Process (Shane 2003).

This model depicted in Figure 5, shows that the identification of entrepreneurial opportunities is the first step in the entrepreneurial process, necessary and essential for all others that follow (Baron 2004; Kirzner 1979; Shane and Venkatamaran 2000; Venkatamaran 1997). Most generally, the term refers to all the efforts of economic agents of "[…] identifying ideas for new products, services, markets, or means of production that are not currently being exploited." (Baron 2004, p. 48) Shane (2003) defines opportunity identification as "[…] a situation in which a person can exploit a new business idea that has the potential to generate a profit." (Shane 2003, p.5) In such a view the opportunity identification or discovery process (alertness) can be conceptualised in the following way: an economic actor experiences new events in every moment and receiving this external information, he uses his interpretation framework to make the best use of what has become available (Yu 2001); some scholars would say, the economic agent conceives the best available means-ends framework (for instance Shane 2003). If eventually an event is perceived that is difficult to interpret individuals react differently: some will simply reject this new event as a deviance or an obstacle not fitting into the activated interpretation framework; some might even simply ignore it in this case. However, individuals that are alert are able to see things differently and move out of the routine track deriving from their interpretation framework and create (Yu 2001).

In this context it should be noted that an individual 'can' exploit an entrepreneurial opportunity identified, but not necessarily must do so; this somehow trivial statement is important to doing research on the entrepreneurial process and underlines the clear distinction made here between opportunity identification and exploitation. For purposes of clarification, these two are strictly separated. This is of crucial importance to entrepreneurship research efforts in general and in particular for the cognitive approach of this work. It is only a methodological comfort to include all entrepreneurs active in a market in a sample to investigate opportunity identification. Theoretically, the exploitation of an idea must not be connected with its discovery and the corresponding individual.

Consequently, whenever the term opportunity identification is used in the present work, it refers to the mental creation of wealth (McClelland 1976; Stevenson et al. 1998) and ends with the "[…] ideas for services or products that meet needs at acceptable prices." (Herron and Sapienza 1992, p. 51) This definition explicitly excludes the organisational element (Gaglio and Katz 2001) insofar that the entrepreneurial individual can identify an opportunity in any role or position in the market. In a first instance it is not of interest if the individual is self-employed, a manager in an existing firm, or whatsoever; this view allows the accommodation of opportunity identification wherever it occurs in the economy, as long as it is the identification of potential new goods or services in order to exploit an opportunity (Gaglio and Katz 2001). Theories dedicated to creating ventures must target on other variables.

Figure 6 points out this differentiation alleged in this work: Some individuals identify entrepreneurial opportunities; they build up population I. That an opportunity is recognised does not automatically mean that it will be exploited. The business idea might be forgotten, not be realised due many reasons, e.g. lack of capital, or might be transferred to individuals in population II. These are individuals that have not identified an opportunity themselves but have adopted it through transfer by a transfer channel, such as a license, or probably their social network (see Braun 2006). Population III represents the entrepreneur that is typically referred to in works on entrepreneurship: the one who discovers an entrepreneurial opportunity and finds measures and ways to bring it to a market, and, therefore, belongs to population I and II. A methodological weakness of most studies on opportunity identification is that they suggest they would investigate population III; in fact, they target individuals, which belong to population II, that is have started a business, but not necessarily also belong to population I, which is actually intended to be researched.

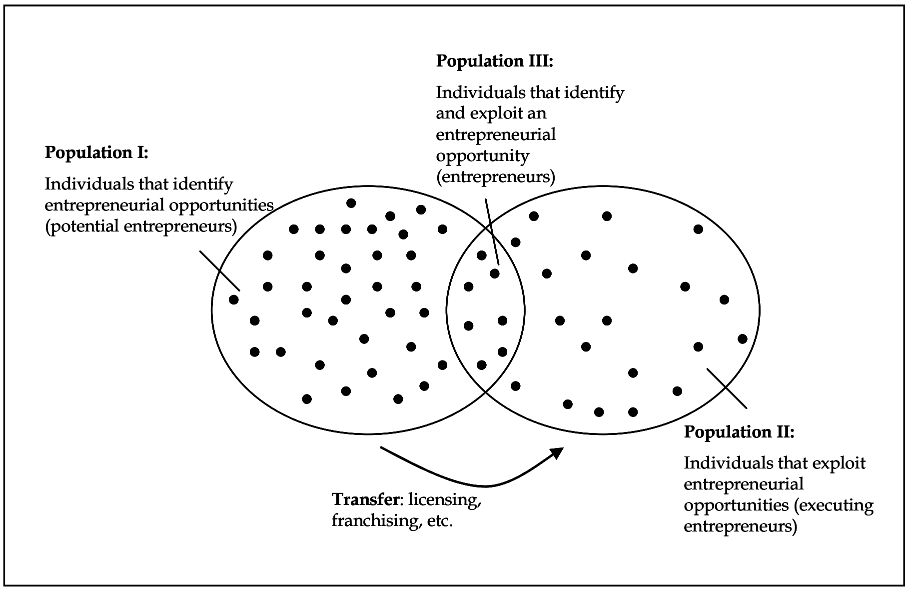

Figure 6 Entrepreneurial Populations.

This clear separation has important implications for studies on opportunity identification. The sample, which should be theoretically surveyed, ought to be drawn from population III or I. In order to overcome this methodological shortcoming, the present study assumes that any individual can potentially belong to population I and recognise entrepreneurial opportunities since practically every individual as economic agent is ceaselessly confronted with economic situations that hold potential opportunities. They only differ to the degree to which the solution they have for an economic problem situation might be regarded as entrepreneurial. This central assumption of the present view will be discussed thoroughly in the following chapters.

It should be apparent by now that the general notion of entrepreneurship and opportunity identification in the present work are heavily based on conceptions of the Austrian economic school. Derived from these ideas and the general notion of entrepreneurship briefly outlined above, it has become the central question in entrepreneurship research, why some people and not others are able to discover and exploit particular entrepreneurial opportunities? (Baron 1998; Gaglio and Katz 2001; Hills et al. 2004a, b; Mitchell et al. 2004; Mitchell et al. 2002; Shane 2000; Stevenson and Jarillo-Massi 1990; Timmons et al. 1987; Venkatamaran 1997). Although this fundamental question already indicates that research on opportunity identification is one of the essential parts (if not the most important one) of entrepreneurship, research on this topic is still in its infancy and is rather a scattering of descriptive studies than a systematic research program of theory testing and development (Gaglio and Katz 2001). The operational implication for research in this field "[…] is that sufficient evidence about the nature of opportunity recognition needs to be generated before on could reasonably offer hypotheses." (Gartner and Shaver 2004, p. 35)

The research program on this central aspect is still directed to gain fundamental insights, providing footage for forthcoming efforts. Before further considerations are made in the following chapters, some terminological remarks are now given to clearly distinguish several terms used and avoid unnecessary confusion in dealing with this issue. The terms of discovery and identification of entrepreneurial opportunities are understood as referring to the general concept in a very general sense. They contain all aspects that are related to the topic, not implying a certain perspective assumed. In contrast, under the term of opportunity recognition all considerations are subsumed that assume a cognitive perspective aiming at applying a psychological view on the phenomenon. Such a distinction should help the reader to go through the explanations and comments in the present work.

Another amendment might be of interest for the attentive or alert reader: the author is fully aware of the paradox, the use of the above mentioned terms might cause in assuming a constructivist position. Terms like discovery, identification, or recognition somehow suggest that there is something that exists out there that is an entrepreneurial opportunity in an objective sense. However, it is one of the central arguments of the present work that it must be distinguished between economic situations that are out there, but are under certain conditions and circumstance subjectively transformed or construed by an individual into an entrepreneurial opportunity. Therefore, a term like opportunity construction would be more appropriate to describe the approach selected here. Nevertheless, the philosophical position alleged here also points out that everything is seen, understood, and evaluated in relation to a reference system:

Here, this is the terminological reference system that has been introduced by the scientific community dealing with this phenomenon. In order to provide a basis for scientific discourse and mutual enrichment, the terms mentioned are overtaken and applied in the present work. Similarly, the term of entrepreneurial opportunities is central to the phenomenon of entrepreneurship and apparently deserves a more detailed discussion. In the following paragraph, the central objective is to provide the reader with a provisional definition, until the particular view of the present work is introduced and a corresponding definition or view on entrepreneurial opportunities can be established.

C. Entrepreneurial Opportunities and their Identification

1. Entrepreneurial Opportunities

It has already been outlined that entrepreneurs and entrepreneurial opportunities are the two central aspects of entrepreneurship. And indeed, if it is asked what delineates the domain of entrepreneurship as a distinct academic and scientific endeavour, various scholars emphasise the fundamental and critical role of opportunities in entrepreneurship (Corbett 2005; Gaglio 1997; Gaglio 2004; Gaglio and Katz 2001; Kirzner 1979; Shane and Venkatamaran 2000). They represent an integral part, without which entrepreneurship could not even take place (Shane and Venkatamaran 2000; Singh 2000). It could even be said that entrepreneurship is opportunity-driven (Hart et al. 1995); this importance is also in many definitions of entrepreneurship that regard it as a process through which individuals pursue opportunities (e.g. Stevenson and Jarillo 1990; Stevenson et al. 1989; Stewart 1911).

Etymologically, independent of an economic setting, an opportunity is defined as "[…] a favourable junction of circumstances, or a good chance for advancement or progress."

(Webster's Dictionary 1988, p. 828); or "[…] a time, condition, or set of circumstances permitting or favourable to a particular action or purpose." (Oxford Dictionary of English 2004) Both definitions emphasise the dependence on circumstance. Again, this can be defined as "[…] a condition, fact, or event accompanying, conditioning or determining another, or a piece of evidence that indicates the probability of an event, or the sum of essential and environmental factors […]" (Webster's Dictionary 1988, p. 242) or "[…] the condition or state of affairs; surrounding and affecting an agent; esp. the external conditions prevailing at the time." (Oxford Dictionary of English 2004) Broadly speaking it could be inferred from these definitions that opportunities are "favourable events" (Gartner and Shaver 2004, p. 30).

As the previous considerations have already implicitly, and sometimes even explicitly, indicated, the metaphysical position chosen for a model of entrepreneurship also alters the corresponding conceptual nature of entrepreneurial opportunities (Gartner and Shaver 2004). The central question for the topic of opportunity identification in this context might consist in whether entrepreneurial opportunities are assumed to exist in the world in some objective sense, waiting to be discovered by the enterprising individual, or whether they are thought to be socially constructed by such individuals, therefore only existing in dependence on the entrepreneur (Alvarez 2005; Chandler et al. 2003; Gartner et al. 1999; Gatewoods et al. 1994; Sarasvathy et al. 2002).

An objective view of the world is based on logic and assumes that there is a reality, which can be perceived accurately by imperfect human agents; it follows that agents must remove the obstacle of accurate perception of the objective world in order to discover entrepreneurial opportunities. Principally, it follows, given that human agents are theoretically capable of removing all insufficiencies in order to obtain perfect recognition of the objective world, i.e. to become perfectly rational decision-makers (Boland 1978), that there exists an end of economic development resulting in equilibrium with rational decision-makers (Kirzner 1973). Thus, irrespective of an individual's perceptions of the external world, the latter itself has a substantive influence on the outcomes of the individual's behaviour and choices (Carrol and Hannan 2000; Pfeffer and Salancik 1978).

In such an objective view, knowledge exists without a context of how and why individuals are related to or interact with it (Gartner and Shaver 2004). This means that entrepreneurial opportunities exist independent of subjects (Kirzner 1997), which either accurately perceive them or not (Shane and Venkatamaran 2000). Such a view is significantly more similar to the view on humans in neoclassicism than the described subjective, constructivist perspective locating the original source of change in the creative forces of humans (Alvarez 2005). This means for the conception of entrepreneurial opportunities that they are construed and human creativity is an infinite, inexhaustible source of new entrepreneurial opportunities, stimulating continuous change and evolution in economic system.

Focussing more on creative individuals, it has been pointed out that in a relativist or subjective view decisions of individuals are based on their perceptions of the salient features of the environment, irrespective of how an environment might be objectively measured (if it can be done) (Lawrence and Lorsch 1967; March and Olson 1976). In the context of entrepreneurial opportunities this view implies that individuals act to explore their ability to influence and make sense of the situation they are situated in, i.e. the entrepreneur actually constructs opportunities.

According to a subjective view, an entrepreneurial opportunity, therefore, is the opportunity to construct new products, services, or markets (Aldrich and Martinez 2003; Sarasvathy 2004). Such a view already intimates the role of mental constructs in the process of opportunity identification (Yu 2001). In this work, Sarasvathy's conviction is shared "[…] that these opportunities are a result of the efforts of particular entrepreneurs striving to construct corridors from their personal experiences to stable economic and sociological institutions that comprise organisations and markets we see in the world." (Sarasvathy 2004, p. 11; see also Sarasvathy 2003)

However, while utterly supporting a constructivist stance, for the purpose of the present work it is not decisive to choose some point on this dichotomy between a subjectivist and objectivist view since it touches not the core of the present work: For the view of cognitive constructivism assumed in this work, it is actually not interesting of which ontological nature objects (here: opportunities) are since it is an interesting, but still a rather philosophical question. "Nevertheless, the issue of whether opportunities have already existed or not is irrelevant in the subjectivist framework. What is important is that an opportunity needs to be identified by the entrepreneur." (Yu 2001, p. 50) In other words, the present work focuses on construing individuals that have subjective perceptions of the external world in any case, thereby assuming a social constructivist view, implicitly adopted in most studies in the field (Gaglio and Katz 2001; Gartner and Shaver 2004). It is assumed in a social-psychological perspective that people behave as if there exist opportunities that some individuals, but not all individuals, will identify and eventually exploit. Hence, independent of the underlying ontology, opportunities are construed and not identified or discovered. This also includes that individuals make sense of the situation they are confronted with, based on knowledge, sometimes called interpretative frameworks (Gartner and Shaver 2004), they already possess (Gooding and Kinicki 1995).

This view only stands in line with a substantial base of theoretical work on decision making in general (Simon 1960; Tversky and Kahnemann 1981). Put differently, entrepreneurs offer their opinion about an event's or set of stimulus' meaning through the creation and introduction of a new means-ends frameworks (a new product, service, or process), which are legitimated or rejected by other economic actors in the market place through purchase, consumption, and imitation (Gaglio and Katz 2001). Following such a position, the relevant questions as to entrepreneurs should focus on an entrepreneur's perceptions and decision making behaviour; i.e. how market environments are represented and interpreted in the mind of the entrepreneur so that opportunity identification occurs?

Further, it ought to be clarified if, and in case the answer is yes how, these representations and interpretations differ from those of other economic agents? (Shaver and Scott 1991) Along these lines Baron (2004) argues that opportunities exist as a potential, a pattern that could potentially observed, coming into existence in the external world as a result of changes in the economic system; but this externally existing object is only the potential for opportunity that has to be converted into an entrepreneurial opportunity by active cognitive processing of the human mind.

In summary, the present work assumes a view based on cognitive constructivism, seen in the subjectivist tradition (Hesse 1990; Koch 1998). This conception of reality and its ontology, respectively the epistemology, has several implications for the present concept of entrepreneurial opportunities. Accordingly, an opportunity is regarded as […] a kind of subjective utility mapping, wherein one assesses how valued a future state might be and how reasonable it is for one to expect to be able to attain that state." (Krackhardt 1995, p. 54) Applying this philosophical stance to the field of research on opportunity identification also means to find processes that explain the mental construction of such future states in economic situations. In order to point out the consequences of such a constructivist ontological position in modelling economic agents and to demarcate differences to classical economic conceptions, often related to the term homo oeconomicus, the general model of human action in time underlying the present work is presented in the following; it is one of an array of more recent models that move away from traditional concepts of economic agents since the strict disjunction of neoclassical economy and psychological theories has turned out to be an obstacle for the progress of economic thinking (Albert 2005).

However, if this the term of opportunity refers to everything in the environment, which is not about the entrepreneur, someone is entering an old and controversially discussed issue: if individuals and environment can be seen independent of each other (Gartner and Shaver 2004). Assuming a subjectivistic perspective, it could be said that an entrepreneurial opportunity is perceived as a desirable future state that is different from the current state and it is regarded as feasible to achieve (Christensen et al. 1994).

In an economic context, the term of opportunities was strongly influenced by Penrose (1959), who conceptualised a theory of the firm based on the notion that entrepreneurs recognise productive opportunities and provide the necessary resources to exploit them. “The productive activities of such a firm are governed by what we shall call its ‚productive opportunity’, which comprises all of the productive possibilities that its ‚entrepreneurs’ see and can take advantage of.“ (Penrose 1959, p. 31)

However, although entrepreneurial opportunities are seen as crucial to entrepreneurship, in fact every economic agent tries to make a profit from opportunities on a daily basis: Entrepreneurial opportunities that are dealt with in this work are different from those typically recognised by managers (business opportunities) in existing organisations. It is referred to such opportunities that are proven business opportunities in which the opportunity and economic problem solution have been identified and the problem solving procedures already demonstrated and documented (Gaglio and Katz 2001). In fact, the terms of business idea or idea generation are quite often terminologically confused in the context of opportunity identification and cognition. However, while an idea is surely a core attribute or a prerequisite of an opportunity (Timmons 1990), an idea is not necessarily equivalent to an opportunity (Ko 2004). Rather, it is a stepping-stone in the process towards an opportunity. In this sense an idea is rather a novel thought, which in most cases must be refined and adjusted to obtain a marketable good (Ko 2004).

However, more practically several attempts have been undertaken to be more precisely in differentiating entrepreneurship or entrepreneurial opportunities from ‘mere’ opportunities in this context, which can be categorised into three general concepts, which are not necessarily mutually exclusive: timing of the pursuit; way of pursuit, and kind of opportunity identification (Gaglio 2004). (1) It has been argued that entrepreneurs are the first to identify and pursue new business opportunities, while non-entrepreneurs just imitate, in case a venture turns out to be successful (Kirzner 1979, 1985); therefore they see the difference in the timing of pursuit. (2) Other scholars rather emphasise the way of pursuit: Entrepreneurs engage in the act of venture creation, while other economic agents prefer other organisational arrangements (Timmons et al. 1987). (3) A third perspective sees the main difference in the kind of business opportunity that is identified: those that are innovative or radical to a society or industry are regarded as entrepreneurial opportunities (Gaglio and Katz 2001; Schumpeter 1934; Shane and Venkatamaran 2000).

However, most generally, an entrepreneurial opportunity can only be discovered by entrepreneurs who differentiate it from a business opportunity, which can be identified by all economic agents (Gaglio 2004). This somewhat tautological argument can be enhanced by regarding an entrepreneurial opportunity as a new means-ends framework, differing from optimisation opportunities in altering means and ends, instead of taken them as given; these are creative options of combining resources constructed by entrepreneurial individuals. Therefore, applied to the issue of the present work, an entrepreneurial opportunity could be defined "[...] as a situation in which a person can create a new means-ends framework for recombining resources that the entrepreneur believes will yield a profit […]" (Shane 2003, p. 18); this formation of new means, ends, or means-ends relationships results in new goods, services, raw materials, markets and organising methods (Eckhardt and Shane 2003).

However, the question arises, what occurrences in economic processes lead to entrepreneurial opportunities, and what are their sources or origins? The major source for opportunities is change in an economy or a market: as has been described, a market in equilibrium does not yield any profit opportunity. However, continuous change of manifold nature gives entrepreneurial agents to take advantage and realise such a profit (Holcombe 2003). Factors that might disequilibrate the market are technological changes, political and regulatory changes, as well as social and demographic changes (Shane 2003).

Concerning the latter, sociological theory explicitly suggests that changes in the institutional structure give rise to the emergence of entrepreneurial opportunities since new niches for resource recombination arise (Swaminathan and Wade 2001). Further to this, factors that enhance production possibilities give rise to entrepreneurial opportunities in several ways: For instance, income growth allows entrepreneurs to market new goods or expand the market for such goods, if they are income-elastic (Holcombe 2003). Holcombe (2003) mentions another important aspect, namely that entrepreneurial activity - the exploitation of an opportunity -

itself is an important source of new entrepreneurial opportunities. The main argument is that change introduced by some entrepreneurs (e.g. the internet), gives rise to new opportunities (e.g. all online-services).

Whether approached from an economic or psychological perspective: Entrepreneurial opportunities must be characterised by several cues that allow economic agents to identify or construct them; in addition, this allows putting the term into more concrete terms for subsequent use. Such essential characteristics are outlined hereafter. It should be noted that each characteristic is required to some degree for an entrepreneurial opportunity to exist, but nevertheless their importance varies across economic situations, time, and societies (Baron 2004).

Generally, it could be seen as a common denominator of entrepreneurial opportunities that they all offer an individual to create (1) economic value through taking a particular action. At this stage it does not matter if action is really taken or really profitable, but rather an individual has the expectation and intention to form a better future (Sarasvathy 2004) or the economic agent simply perceives a potential economic value in a situation (Baron 2004). Consequently, a valuable economic opportunity can be exploited to (2) create new wealth, typically providing entrepreneurs with idiosyncratic advantages resulting from specific knowledge. However, they are not only valuable, but also resources for exploitation are rare and they are (3) imperfectly imitable (Fiet et al. 2004b).

Further to this, Baron (2004) states that "[…] an opportunity involves the potential to create something new […] that has the potential to generate economic value (i.e., profit), and that is viewed as desirable in the society in which it occurs (i.e., its development is consistent with existing legal and moral standards, and would, therefore, not be blocked or constrained by these standards)." (Baron 2004, p. 50) Such a definition covers the essential aspects and adds the characteristics of (4) perceived desirability and (5) newness or novelty. Again, the fourth characteristic emphasises that it is up to the individual at hand to perceive an opportunity as desirable, for instance socially (Baron 2004). But the problem arises that perceived desirability can differ greatly over time and across societies. Under certain circumstances changing health, legal, and moral standards can convert a formerly viable opportunity into an illegal action; as has happened with cocaine and marijuana, which were legal in the US until approximately as medical drugs (Baron 2004). Alternatively, Hills et al. (2004a, b) view an opportunity rather from a customer value perspective. They regard customer value as a perceived preference (by the customer) for and evaluation of a product's attributes, attribute performances, and consequences arising from use that facilitated or hinders obtaining the customer's goals and purposes. Consequently an entrepreneur perceives a new opportunity if he sees a chance to create such value and construct a marketable good around this opportunity or chance (Santos and Eisenhardt 2005).

Concerning the fifth aspect of novelty, it is important to note in this context that it is a highly relative term. In a normative sense it can be restricted to new products or services, new markets, new production processes, new raw material, new ways of organising existing technologies, and so on that would be generally viewed by experts as representing something that does not currently exist. An opportunity identified in this sense is not currently developed or exploited by another entrepreneur, nor has it ever been. Alternatively, a prima facie newness by a single individual could be assumed to be a sufficient requirement (Baron 2004).

Another indicator for assessing the degree of novelty might be to find out to which degree the new problem solution departures from standard business practices within an industry: If only little, it is what Schumpeter (1934) called routine combinations. Opportunities of this type are pursued by non-entrepreneurs in the name of efficiency and improvement of the return on investment (Gaglio 2004). In that sense they resemble to Kirznerian (1979) opportunities. In turn, entrepreneurial opportunities are seen as discontinuous innovations, brought about by what Schumpeter (1934) calls new combination or Kirzner (1985) names breaking existing means-ends frameworks. Unfortunately, the concept of novelty is accompanied by many problems for the scholar dealing with it, as chapter II.A related to central philosophical considerations on creative economic behaviour has pointed out.

Notwithstanding, many scholars in the field distinguish opportunities according to their degree of newness. For instance, Yu (2001) distinguishes two kinds of entrepreneurial discoveries: despite explicitly using the approach of Dosi et al. (1997), the ordinary and extraordinary type resemble to the Schumpeterian and Kirznerian notions of entrepreneurship. They mainly differ as to the implications they have for economic systems when they are exploited and explored, exhibiting a different degree of technological breakthrough or magnitude of creativity involved (Yu 2001). Further, Gaglio (2004) suggests a typology of opportunities based on previous research on innovation. The main idea is that innovation can be depicted as a continuum along which it can be indicated how discrepant the product, service, or process is in comparison to the respective market's or industry's existing offering and operating procedures. The result is an opportunity scale shown in.

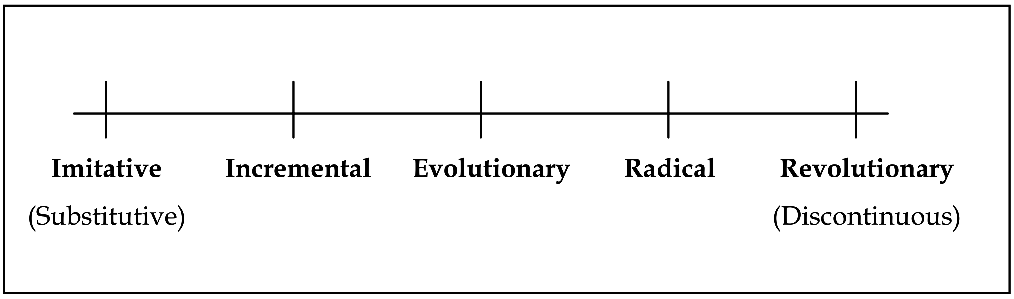

Figure 7 Entrepreneurial Opportunity Scale (Gaglio 2004).

Ignoring the problem of defining newness or novelty, at this point (see chapter II.A.3) it shows an increasing degree of newness from left to right; nevertheless it is not really a continuum, but rather a Likert-type scale. Imitative opportunities are rather substitutes that copy existing and well-known business products, services, or processes in an industry. They represent something new to the individual or the enterprise at hand, but not to the industry or the world (since they already exist somewhere else; otherwise they could not be copied); in the field of marketing, those are sometimes called me-too innovations (Christensen and Raynor 2003). Incremental ideas or opportunities are such that are obvious and expected improvements of existing products, services, or processes. But efficiency can be improved by making it cheaper, better, or faster; such are for instance extensions or upgrades that are clearly predictable (Mascitelli 2000). Theoretically, it is totally new to the individual or enterprise and the industry, but has not such a deep impact since it is expected and does not require extensive changes.

Evolutionary opportunities are new to the individual or enterprise and new to the industry, but not new to the world. For instance, it could be thought of technologies imported from other industries. Again different, radical opportunities represent products or processes still based on familiar but reengineered features or technologies. Literature on innovation quantifies that such innovation produce a five or ten-fold performance improvement or at least a 30-50% reduction in costs (Chandy and Tellis 2000; O’Connor and Rice 2001).

However, the perhaps most eye-catching opportunities are revolutionary or discontinuous, sometimes even called a breakthrough: such an opportunity is new to everyone, the individual or enterprise, industry or the world. Such innovations offer advanced capabilities that could not be obtained by extension or adoption of already existing technologies. Typically, such paradigm shifts hit an industry or market unanticipated and persistently change the nature and the rules of the game (O’Connor and Rice 2001). Such opportunities correspond to

Schumpeterian creative destruction and Kirznerian break of existing means-ends frameworks. Often, such developments trigger off the emergence of a new industry.

This points us to a sixth characteristic, which has already been given, that entrepreneurial opportunities are (6) path-dependent and always hold a linkage to previous goods or services. Problematic is in this context that an opportunity can be located on different locations of the entrepreneurial opportunity scale, depending on who is confronted with it. Thus, according to cognitive subjectivity, it can be simply judged or perceived differently. It might be most feasible and most acceptable to draw on the social consensus in an industry to find a common denominator for the degree of novelty (Gaglio 2004).

Summarising this paragraph with a provisional definition of an entrepreneurial opportunity based on existing literature, it is said that an entrepreneurial opportunity is regarded as an economic situation, an individual is confronted with at a point in space and time and thinks an economic value is contained that allows to create wealth, which is socially desired, by measures that are imperfectly imitable and bear a form of newness or novelty. Apparently, many scholars have undertaken efforts to explain, how individual identify such opportunities. Some influential contributions to answering this question are outlined in the following paragraph; however, the following treatment of the issue is limited to general research attempts, which is here called research on opportunity identification, and not particularly those adopting a cognitive perspective, which is here named research opportunity recognition, and will be dealt with in some more detail in chapter IV.A.

2. Research on Identification of Entrepreneurial Opportunities

As the previous considerations have already suggested, research on opportunity identification is highly heterogeneous with different strands focussing on different aspects of the phenomenon. The variety of studies in Butler’s editorial book (2004) on ‘Opportunity Identification and Entrepreneurial Behavior’ provides a good impression, from which variety of perspectives the topic can be approached, such as social psychology, cognitive psychology, venture founding, innovation, or cultural aspects.

While early research on entrepreneurship and opportunity identification was focused on individual differences and personal characteristics of entrepreneurs, more recent approaches try to find integrated process models, depicting entrepreneurial phenomena (Bygrave 1995;

Hills et al. 1997). However, like most efforts in the field of entrepreneurship, research on opportunity recognition is still highly focussed on the individual, the entrepreneur as person discovering and pursuing an opportunity (Casson 1982; Kirzner 1979; Schumpeter 1934). Individuality is reflected in the superordinate question already mentioned, why some people and not others identify entrepreneurial opportunities (Dimov 2004, p. 136). In pursuing such a methodological individualism, the personality trait-approach already mentioned was as unsuccessful in terms of explaining the phenomenon of opportunity identification as (Gartner 1989). Nevertheless, the individual still seems to be a good point of departure since it has a cognitive influence throughout the process on the surrounding environment (Shaver and Scott 1991) and individuals accumulate specific knowledge applied in the opportunity identification process (Shane 2000).

Not surprisingly, given the streams' infancy, no unifying theoretical framework for understanding or explaining the nature of opportunity identification and its role in the entrepreneurial process has been agreed on yet (Baron 2004). For instance, several scholars demand to regard opportunity recognition as an interaction between individual and context instead of simply focussing on the individual (Dimov 2004). This does not only accord with the theories on leadership and human behaviour, but is also emphasised in other fields of economics, such as evolutionary economics (see e.g. Braun 2006), and has actually also been considered in recent theories of entrepreneurship (see e.g. Shane 2003).

General models almost unanimously name two main aspects to which individuals differ and can help to explain why some identify entrepreneurial opportunities and some do not: firstly, superior knowledge or information necessary to identify opportunities and, secondly, superior cognitive capabilities to make the mental connections between these information, which finally can lead to opportunities (see for instance Ko 2004; Mitchell et al. 2002; Shane 2003; Shane and Venkatamaran 2000; Venkatamaran 1997). Apparently, these resemble to the two main elements of human thinking that will be outlined to represent the methodological building blocks of cognitive psychology in chapter III.A.1. However, before dealing with that in more detail some often cited approaches to generally model the opportunity identification process are introduced.

The reference to psychological aspects of human thinking is also apparent in general attempts to model opportunity identification, if argued that it is a special case of creative thinking. Following this view, several general process models, which might be subsumed as the creativity-based approach to opportunity identification (Corbett 2005), have been introduced.

The relationship between the conception of discovering an entrepreneurial opportunity and the creative process in general can be regarded as an analogy (Dimov 2004) since previous attempts to apply a creative process framework to opportunity recognition have fallen back on the discrete stage-model of Wallas (1926) (see for details on that model chapter III.C.1).

For instance, Long and McMullan (1984) proposed a four-stage model based on this concept, including the stages of pre-vision, point of vision, opportunity elaboration, and decision to proceed. Methodologically, these surveys were based on retrospective reports of entrepreneurs about the origin and elements of 'their' opportunity recognition process. As result of such studies, opportunity identification has been modelled as a complex process of multiple stages since researchers and entrepreneurs reflecting about 'their' opportunity identification unanimously state that it is not a discrete event, but rather a process (Hills et al. 1997); this corresponds to insights of cognitive psychology about thinking processes. For instance, Hills, Shrader, and Lumpkin (1999) asked business owners and entrepreneurs about the degree to which they agreed to several statements regarding the opportunity recognition process.

Their results showed a high consistency with the model proposed by Wallas (1926). Since a detailed presentation of all of them would fill a chapter of its own with relatively limited value for the present work it is refrained from a detailed review of all these approaches (see for an overview Hills et al. 1997; Lumpkin et al. 2001; Singh et al. 1999a). Instead, only one model will be presented in some more detail, functioning as an example for a lot of models (see for other studies trying to identify and map the stages or phases of the opportunity identification process: Ardichvili et al. 2003; Herron and Sapienza 1992; Long and McCullan 1984).

This model of Lumpkin et al. (2001, 2004) is precisely such a model based on the conjecture that opportunity recognition is a form of creativity. Consequently, it is based on an often referred to five step model of creative thinking, (see for instance Csikszentmihalyi 1996), and applied to the setting of entrepreneurial discovery. Corresponding to Shane and Venkataraman's (2000) primary components of opportunity identification, Lumpkin et al. structure their model into discovery and formation phases.

While the discovery phase includes sub-stages of preparation, incubation, and insight, the stages of evaluation and elaboration belong to the formation phase (Lumpkin et al. 2004). During the (1) preparation phase an individual accumulates knowledge by collecting experience in a field of interest. This is accompanied by the development of sensitivity to the issues and problems in this domain. The following phase of (2) incubation is not considered as a conscious act of problem solving or systematic analysis. Rather, it is seen as an intuitive, non-linear, mostly unconscious or even unintended way to develop possibilities or options. Initially, the third phase of (3) insight has been seen as the illuminating moment, in which the individual consciously realises that his idea might be an entrepreneurial opportunity. “This moment of conscious awareness involves a cognitive shift that crystallises awareness and forever changes the way a concept is framed.“ (Lumpkin et al. 2001, p. 16)

The central idea, which entered the conscious mind in the aha-moment, is subsequently subject to (4) evaluation: This includes an assessment of the considerations executed so far as to their viability and feasibility; in other words, the thinking processes are verified, which apparently also implies that the assumptions made in the first two phases are reflected; efforts in this stage are more or less all about the central question: “Is the business concept sufficiently valuable and worthwhile to pursue?“ (Lumpkin et al. 2001, p. 18) The final stage of this model, the phase of (5) elaboration refers to the detailed work out of the entrepreneurial opportunity, by operationalising the previously developed question and the ideas to answer it. Lumpkin et al. (2001) mention writing a business plan as a typical elaborating activity. Very often, ideas and assumptions made in earlier stages are refined as a result of feedback processes. Therefore, the rather linear process described receives a recursive character by integrating learning loops (see for more Braun 2006; Kappelhoff 2004).

However, in view of the recent developments in cognitive research on creative thought (see chapter III.C.2), such stage approaches seem outdated and not adequate to account for different types of entrepreneurial opportunities and to answer how these particular types are related to the discovering individual. Generally, it can be criticised that the approaches are rather descriptive than capable to discover interpersonal differences (Dimov 2004). Consequently, more recent attempts in the field of entrepreneurship focus on cognitive processes involved in opportunity recognition, such as conceptual combination, analogy, and initial problem formulation (Ward 2004). The present work follows this recent research trend, focussing on information processing or cognitive processes not on the somehow fuzzy term of creativity.

Another way of approaching the phenomenon of opportunity identification chosen by scholar consists in regarding it as a search process. Along such lines, Bhave’s (1994) often cited process model of new venture creation proposed two ways leading to opportunity identification. On the one hand, the decision can be taken to start up a business, and, on the other hand, a need can be first recognised to which a solution is subsequently developed. This already implies the distinction of whether the intentional decision to start a business comes first and is then followed by a search for an opportunity, or, vice versa, an opportunity is recognised, which then leads to the decision to exploit it.

Along these lines, some authors propose the distinction between deliberate or intentional search and serendipity (Long and McCullan 1984; Koller 1988). However, a wide range of scholars argue that systematic search for an entrepreneurial opportunity is impossible. They bring up different arguments basing on Kirzner's (1979) notion of alertness without search, such as that an individual is only able to possess limited knowledge and, therefore, is limited in its ability to conduct an optimal search (Baumnol 1993; Casson 1995). Also very popular is the contention that it is simply impossible to search systematically for anything that is yet unknown. This notion implies that any discovery happens to be accidentally, rather surprising the discovering individual (Baumnol 1993; Sarasvathy et al. 2003; Yu 2001; Kirzner 1997) and cannot be planned (Baumnol 1993; Kaish and Gilad 1991; Kirzner 1997; Sarasvathy et al. 2003; Shane and Venkatamaran 2000; Venkatamaran 1997; Yu 2001). This view is supported by empirical results suggesting that the identification of entrepreneurial opportunities is rather based on personal insights and intuitive processes than on systematic search efforts (Singh et al. 1999a). Other scholars reason that this restricts most research on discovery in the field on actual entrepreneurial behaviour, thus impeding the development of prescriptive theories of discovery (Fiet et al. 2004b).

In fact, experimental studies suggest that the importance of entrepreneurial alertness in the sense of a special talent that is not possessed by the average individual is generally overrated (Fiet et al. 2002; Fiet et al. 2004a). Instead there is evidence that the execution of a constrained systematic search reduces the cost of investment in the acquisition of specific information related to the cost of the search (Fiet et al. 2004b; Yu 2001), inducing more detailed research of entrepreneurial alertness as motivated propensity (Gaglio and Katz 2001). This conviction is corroborated by further empirical evidence, which claims that the likelihood of identifying an opportunity can be increased by deliberately searching for relevant information (Ko 2004). Such studies compared entrepreneurs and managers and their search for information. Their results hinted to different behaviours (Gilad et al. 1989; Gaglio and Taub 1992), in particular that entrepreneurs spend more time on searching for information

(Kaish and Gilad 1991). However, such findings are somewhat questionable; e.g. an often cited study of Kaish and Gilad (1991) war replicated by Busenitz (1996) with a random sample, but only little support was found for the initially supported hypotheses that entrepreneurs really spend more time searching for information.

Indeed, the argument brought up by critics of this view - that it cannot be searched for a yet unknown object - has some validity since on a fundamental level it is plausible that it is impossible to detect something, of which most characteristics are unknown. But this paradox can be solved if it is assumed that aspiring entrepreneurs are not systematically searching for a particular object (an entrepreneurial opportunity), but are rather 'screening' their information channels for signals; a process called strong interference (Platt 1964).[viii] An approach to model this is the systematic search approach (Fiet et al. 2004b) based on Ronstadt's (1988) corridor principle, which emphasises proactive efforts, but does not indicate to what purpose that activity ought to be directed. Fiet et al. (2004b) suggest, based on their findings of repeat entrepreneurs, that aspiring entrepreneurs should direct their search to domains, in which they already possess prior specific knowledge. They conclude that some entrepreneurs do not wait to let the information hit them (like the concept of alertness suggests), but rather search for it proactively. Therefore, these refined studies support the arguments of older works in the field, which assumed systematic search efforts by entrepreneurs to be of value for discovering entrepreneurial opportunities (see for example Timmons et al. 1987). Other studies in the sub-stream focussing on search efforts try to find out how individuals decide to search for opportunities. This idea is based on the notion of problemistic search (Cyert and March 1963). This assumes that search efforts are triggered off by unrealised expectations.

In the context of the present work, it must be asked which conditions induce individuals to search for entrepreneurial opportunities. For instance, Heron and Sapienza (1992) suggest that current performance under aspiration level might play a significant role. The perhaps most obvious reason for an individual to gain relevant information for discovering an entrepreneurial opportunity are its own efforts to gain such information in the situation at hand. In order to distinguish this from prior knowledge, it could be simply assumed that such information is obtained by the individual at the same time the opportunity is discovered or constructed. This means these two processes take place - more or less - simultaneously. In contrast, the considerations as to prior knowledge focus on previous situations in which information is accumulated.

However, regarding the issue treated here, the literature offers a controversial discussion whether this process of information acquisition is of a passive nature, or proactive efforts are of importance as well. Another solution to resolving the controversy might consist in differentiating between types of opportunities; some scholars argue that the type of knowledge, which is relevant to the opportunity, has an influence of the opportunity itself (Yu 2001). Some knowledge can be gained and learned by deliberate efforts, such as technological knowledge, know-how, where to buy or sell, etc. In turn, other knowledge can only be acquired in a non-deliberate manner, rather absorbed from everyday experience (Kirzner 1979). Therefore, different economic situations allow for a varying degree of proactive information search for entrepreneurial opportunities.

In reviewing the efforts to answer the question of how opportunities are recognised and why some people and not other recognise certain types Dimov (2004) identifies two main research streams: event-driven and outcome-driven studies (see also Aldrich 2001; Van de Ven and Engleman 2004). Such a distinction makes sense in terms of highlighting that two different research orientations provide different insights as to entrepreneurship and opportunity identification. Event-driven approaches are rather built forward, starting with observed events and the development to the outcome; outcome-driven approaches begin with recording outcomes of interest to identifying significant prior causes; consequently, they are rather built backward. Methodologically, this implies that the former approaches attempt to describe a sequence of events in the realisation of a particular outcome, while the latter are rather based on statistical association between a set of independent and dependent variables (Dimov 2004; Van de Ven and Engleman 2004).

In the domain of opportunity identification this distinction leads to two different research questions: while event-driven approaches try to answer the question of how opportunity identification occurs by describing the sequential steps inherent; outcome-driven approaches attempt to shed light on the factors that contribute to or deter the identification of opportunities, thus trying to answer the question why some people and not others are successful in doing so (Dimov 2004, p. 137). The present study, as will become clear later on, methodologically belongs to the latter stream since it is hypothesised that certain cognitive preferences and abilities (independent variables) lead to the recognition of profitable and novel entrepreneurial opportunities (dependent variable). After reviewing such general models providing a framework for investigating the phenomenon, such central variables that have been found to influence the probability of an individual to identify entrepreneurial opportunities are now presented.

3. Determinants of Identifying Entrepreneurial Opportunities

Tied up to the two central cognitive elements, which will be introduced in chapter III.A.2, variables could be differentiated in two main categories: firstly, knowledge and information about the external world, and, secondly, individual characteristics. The distinction between these major groups is not new and can be found in different studies, trying to systematise the phenomena of opportunity recognition. For instance, Venkatamaran (1997) focuses on three main aspects in which individuals differ and that might have an influence on the ability to identify entrepreneurial opportunities: (1) knowledge and information, (2) cognitive differences, and (3) behavioural differences. He emphasises that individuals are differently endowed with knowledge. Additionally, they differ regarding the set of skills, aptitudes, insights, and circumstances that are necessary to make the connection between such specific knowledge and an entrepreneurial opportunity. Put differently, it follows that opportunities are not given by information hitting the individual, but rather such information are processed by humans to produce entrepreneurial opportunities (Corbett 2005). Consequently, investigations on the identification of opportunities must deal with information and knowledge individuals possess and the way it is processed in their minds (Venkatamaran 1997). Many other scholars agree on these two major factors of knowledge and information on the one hand and cognitive properties on the other (e.g. Shane and Venkatamaran 2000; Shane 2003). Therefore, the most relevant literature on individual variables moulding opportunity identification is reviewed according to these two major categories.

However, the distinction appears to be somewhat fuzzy, but such confusion can be prevented by considering the time-dimension: In the model of human action in time, which has been introduced, knowledge and information available build up the basis for action. Being more precise, it can be distinguished between knowledge, heuristics, and preferences that have been acquired through prior actions in previous periods (in t_{n-m}). Such learning processes guiding current decisions and actions in the current situation (in t_n) are subject of many studies focussing on economic agent's learning (Brenner 1999; Riechmann 2001). However, such individual characteristics built up by previous situations (and therefore previously available information) should be distinguished from information that is available and cognitive processes operated in the situation at hand, in t_n. Such a differentiation is necessary to distinguish interpersonal variances in the ability to recognise entrepreneurial opportunities. Concluding, it will be distinguished between knowledge, resulting from t_{n-m}, and information and cognitive processes or abilities in t_n.

Concerning individual differences regarding superior knowledge and access to information, it is argued quite generally that some individuals possess exclusive information, which enables them to discover entrepreneurial opportunities other economic actors ignore since they simply lack relevant information (see Hayek (1945). Perhaps, one might instantly think of path-breaking new insights in scientific research. But such informational advantages, triggered off by information asymmetries are "[…] virtually universal in the economy, representing a significant component of almost all transaction." (Arrow 1985, p. 37) In the following, it will be presented a literature review on studies especially focusing on the aspect of opportunity identification and information respectively knowledge. It will be started with knowledge acquired in t_{n-m} that represents prior knowledge for the situation in t_n .

This idiosyncratic stock of knowledge previously accumulated can increase the likelihood of opportunity identification as well (Ko 2004). Each individual has a different stock of personal prior information acquired through life experience, which increases the chance to identify an opportunity in specific situations (Shane 2000). Empirical studies suggest that a few different aspects are of particular interest in this context: the form of job function(s), the general variation in experience, and special interest (Shane 2003; Vesper 1996).

Concerning an individual's job experience, it is perhaps palpable that a physician or chemist has a higher probability of obtaining relevant information for identifying an entrepreneurial opportunity than does an historian. This is because they are typically more frequently confronted with information that might be of interest for an entrepreneurial opportunity, i.e. they accumulate knowledge that can be transformed into a marketable good or service (Shane 2003). More generally, this suggests that certain professions have a privileged access to relevant information; particularly, jobs in research and development should be mentioned since there new information is generated that triggers off technological change (Hippel 1986, 1988). This statement can be generalised to any job where information is generated or first obtained from the typical sources of entrepreneurial opportunities. Empirical research, albeit of exploratory nature, suggests that business owners have indeed obtained prior knowledge by working in a company offering a similar or even the same product or service (Young and Francis 1991).

In addition to job positions, Shane (2003) uses the metaphor of a puzzle to emphasise the role of varying life experience in the process of opportunity identification. He states that new incoming information might serve as the connecting element between previously available information, which allows an individual to recognise an opportunity. Individual differences in life experience are likely to influence the probability to obtain such crucial information in t_n. Frequently, such knowledge, respectively such relevant information, is acquired during former jobs in different organisations. A high degree of such experience and expertise is therefore hypothesised to increase the ability to recognise entrepreneurial opportunities (Romanelli and Schoonhoven 2001). Similarly, some scholars argue that such ability grows with the number of markets an individual has collected experience in (Shane 2003).

In summary, it could be concluded that at any given point in time only some individuals are able to identify a given opportunity since they have previously acquired relevant knowledge to correctly ‘understand’ the incoming information (Gaglio 2004; Venkatamaran 1997). This corresponds to Ronstadt’s (1988) corridor principle, already mentioned here (see previous chapter II.C.2, and shows that prior knowledge and incoming information are closely interrelated. Accordingly, Shane (2000) stated that the eight cases studies he executed supported the hypothesis that entrepreneurs tend to engage in markets, where they have previous experience. Further to this, Ardichvili et al. (2003) came to four specific propositions about the relation between knowledge and opportunity recognition, in particular concerning the types of knowledge an individual possesses. They argue that (1) special interest knowledge and general industry knowledge, (2) prior knowledge of markets, (3) prior knowledge of customer problems, and (4) prior knowledge of ways to serve markets will all increase the likelihood of successful entrepreneurial opportunity identification.

Shane (2000) alleges another classification distinguishing three dimensions according to which type of relevant information for opportunity recognition individuals differ. (1) Firstly, prior knowledge about markets enables individuals to understand demand conditions (Shane 2003). For example, such information or knowledge could be about crucial relationships, sales techniques or requirements for capital acquisition (Hippel 1988). (2) Secondly, prior knowledge about how to serve markets puts individuals into the position to understand and know the rules and operations in the markets. Particularly, in identifying production or marketing gains from introducing a new product or service in the market (Johnson 1986). (3) Thirdly and finally, prior knowledge about customer problems increases the probability of identifying opportunities by assisting in finding a new product or service that solves a customer problem or satisfies a, so-far, unmet need (Hippel 1988). Further empirical research claims that successful entrepreneurs have obtained information from private sources, compared to average entrepreneurs, which gained such information through public sources such as magazines or newspaper. It could be inferred that private sources of information are more promising as random search (Hills and Shrader 1998).

As indicated, studies on prior knowledge focus on occurrences in t_n. Further research tries to shed a light on the variables that determine the access to relevant information in t_n. Here, the social relations of the individual are often mentioned as one of the most important factors influencing an individual's behaviour. The argument that all transactions and economic actions, even in markets, are socially embedded (Granovetter 1985) has led to a controversial discussion, whether the individual level is the right one to investigate on, or rather a holistic perspective sheds more light on a phenomenon (see for more Braun 2006).[ix] Scholars assuming a holistic view might investigate an individual's social network. A social network could be defined as "[…] a specific set of linkages among a defined set of actors, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behaviour of the actors involved." (Mitchell 1969, p. 2) Apparently, there exist many other possibilities to define an individual's network (see e.g. Pappi 1987 or Koschatzky 2001); however, it is assumed that type, quantity, and speed of information that an entrepreneur receives are mainly contingent on the structure of his social network (Shane 2003), an analysis of relationships building it up might offer interesting insights on opportunity identification.

A rather sketchy perspective would distinguish the relationships as to the dimensions of form, content, and intensity, though it should be noted that only the two latter constitute a network's structure (Sydow 1992). The content of a relation or network is determined by the object of exchange, which can be theoretically everything that is exchangeable. Since the social network is seen as a channel for gaining superior information the relevant object of exchange in the context of opportunity identification is information or knowledge. The fact that social relationships differ as to their intensity has led to a range of studies focussing on the effects of such differences for a variety of phenomena.

An influential classification of relationships distinguishes between weak and strong ties. These terms were mainly shaped by Granovetter (1973), who introduced them to distinguish relations with different degrees of intensity: weak ties are those that show a low degree of intensity, while strong ties are located on the opposite end of this dichotomy. He further assumed that individuals can only maintain a limited number of strong ties since it requires relatively high effort to keep them (Granovetter 1973). Additionally, and relevant in this context, such strong ties provide relatively trustworthy information, e.g. via relations to close friends or associates (Shane 2003). This so called network closure argument (Coleman 1988) argues that close relations typically provide high-quality information and, therefore, reduce the risk of uncertainty (Arenius and De Clerq 2005). To which degree this quality of information is crucial in the process of opportunity identification is not clear. Its role heavily depends on the notion of opportunity identification given, e.g. if the refinement of the business idea is included or not. However, such relations are of importance for developing a whole business idea, for instance in building up a trustworthy network of potential investors (Shane and Cable 2002). At this stage, considering social networks and innovation, the concept of liability of newness should be mentioned: It is assumed that newness in economic actions is generally accompanied by problems or challenges. Social networks are assumed to support in resolving such obstacles by providing necessary knowledge and resources (Stinchcombe 1965).

In turn, weak ties are those with rather casual acquaintances; information gathered from such contacts is seen as less trustworthy, but it is said that they are an importance source for non-redundant information (Granovetter 1974). They are assumed to be of particular importance for networks dealing with information and diffusion processes (Sydow 1992). In this context, redundant relations are those to more than one actor of the same time; in turn, non-redundancy refers to a unique relation (Burt 1992; Koschatzky 2001). Such non-redundancy in social ties, often referred to as structural holes (Burt 1992), is assumed to increase the likelihood of gaining access to the right complement of information necessary for recognising an entrepreneurial opportunity (Aldrich 1999; Shane 2003). This is because such weak ties are assumed to increase the likelihood of gaining unique information (Arenius and DeClerq 2005; Granovetter 1973; Hills et al. 1997; Thornton and Flynn 2003). More precisely, it can be said that the more weak ties an entrepreneur possesses, the more diverse information he possesses (Ko 2004). In turn, entrepreneurs that lack weak ties seem to be disadvantaged since they do not receive information from distant parts of their social system (Granovetter 1973).

Several further empirical studies have been dedicated to the role of social networks in the identification of entrepreneurial opportunities. Koller (1988) found out that approximately the half of the eighty-two firm founders in his sample had their business idea suggested through a business associate, a relative, or another social contact. More precisely, and considering the dimension mentioned above, Kaish and Gilad (1991) found evidence suggesting that entrepreneurs rather use distant contacts or weak ties of their social network than closer ones to identify opportunities. In a replication of this study, Busenitz (1996) could not verify their findings, but rather stated that individuals are more likely to obtain relevant information from contacts they regard as trustworthy.

Hills et al. (1997) distinguished between solo and network entrepreneurs, depending on the degree to which they use their social network for opportunity identification. Their research suggests that the latter are significantly more successful; however their use of the concepts of solo and network entrepreneurs appears critical (see for a more detailed criticism of this study Braun 2006). In an attempt to refine their research on this issue, the same group of scholars found out that the more diverse an individual's network is, the higher is the likelihood of opportunity identification (Singh et al. 1999b). Further results have shown that entrepreneurs judge colleagues, friends and relatives as one of their most important sources for relevant information, only exceeded by the importance of relevant experience (Singh et al. 1999b). In a recent study, Arenius and DeClerq (2005) have gathered evidence indicating that the higher an individual's background, the higher is the likelihood that it identifies an entrepreneurial opportunity. But they argue that it is not just the superior prior knowledge accumulated, but foremost the integration in a social network of more knowledgeable individuals.

While it could be argued that everything mentally developed outside the individual's mind at hand is only information acquired through personal relations, some scholars argue that in such a process of opportunity recognition, cognitive processes of more than one individual are actively involved. Taken aside the methodological discussion of individualism or holism already discussed in chapter II.B.3, it is argued that feedback processes in the process of opportunity identification can be executed by members of the individual's social network (Singh et al. 1999b; Thornton and Flynn 2003). This could be regarded as an internalisation of external cognitive processes, which could be called in the context of entrepreneurial opportunities a "[…] social network-opportunity recognition relationship." (Singh et al.1999b, p. 12)

In summary, it is generally assumed that individuals with more diverse information sources have a higher probability of being successful (Aldrich et al. 1987). It seems that in particular diverse social ties provide a superior access to relevant information for opportunity identification (Aldrich and Zimmer 1986). Nevertheless, the availability of relevant information and knowledge alone is not a sufficient fundament for the identification of entrepreneurial opportunities: Incoming information must be correctly or accurately to processed against the background of prior knowledge.

Many attempts have already been done by researchers in the domain of entrepreneurial cognition research to shed light on such mental operations in recognising entrepreneurial opportunities; these are presented in-depth in chapters IV.A.2 and IV.C, after the psychological fundament is the following chapter III. Then, the reader has gained a more thorough understanding of basics in cognitive psychology and can more easily comprehend arguments and thoughts in this research stream. However, here it is intended to provide a general overview on important variables on opportunity identification; many of them are general abilities or concepts that stem from psychology. These are an individual's (1) absorptive capacity, (2) cognitive capabilities, (3) and creativity (Shane 2003). They are presented at this point in a rather general manner to conclude the brief review on opportunity identification pegging the present work's research field.

To begin with, an individual's absorptive capacity could equally be classified as superior knowledge since it is mainly dependent on an individual's stock of knowledge; it has an ambiguous position, a kind of hermaphrodite between knowledge and cognitive capabilities. However, most authors regard it as a capability since its importance arises from the fact that it facilitates further processing of information in the human mind (Gaglio 2004; Shane 2003). Furthermore, it seems sensible mentioning it here since it makes an impact in t_n. As has been pointed out, individuals differ as to their stock of knowledge; this creates an absorptive capacity, which not only facilitates the acquisition of additional information about technologies, markets, and production process, but also further information processing. This increases the capability of formulating new mean-ends frameworks (Cohen and Levinthal 1990).

Two main reasons are given, why such capacity influences the likelihood of recognising an entrepreneurial opportunity. Firstly, new information is categorised in the context of extant knowledge structures. In case that an individual possesses a strong base of relevant information or knowledge, it has a superior ability to interpret incoming information (Yu

2001). Secondly, this increases an individual's ability to solve problems; it is assumed that superior problem solutions can be devised confronted with a given problem situation (Shane 2003). Apparently, an individual's absorptive capacity is contingent on the type of information that is necessary for recognising an entrepreneurial opportunity. For instance, knowledge how to serve markets supports individuals in estimating, which production or marketing gains can be expected from the introduction of a new product or service, and, even more importantly, if this action yields a profit. An individual is more likely to recognise an opportunity if a product or service is introduced into the market, if aware of how these are produced or distributed, how new input can be integrated into the production process, or which sources of supply are available (Shane 2000).

As already pointed out, it is intended to understand how incoming information is processed in t_n against the background of extant knowledge structures obtained in t_{n-m}. The question how information is processed in entrepreneurial mind has long been used to explain differences in the ability to identify entrepreneurial opportunities (Ko 2004; Shane 2003). Shane (2003) distinguishes four broad categories of cognitive processes, which he regards crucial to the identification of entrepreneurial opportunities: intelligence, perceptive ability, creativity, and risk avoidance, i.e. not seeing risks.

Already Knight (1921) argued that intelligent individuals are more likely to discover entrepreneurial opportunities because it requires collecting and processing information. Ceteris paribus, intelligent individuals can better execute these processes and, thus, are better in discovering opportunities and building expectations about the outcomes of resource recombinations (Knight 1921). Additionally, it could be hypothesised that intelligent individuals can choose from a larger variety of opportunities since their intelligence provides them with a higher number of available means-ends frameworks. This would also mean that they are able to find more valuable opportunities; that is such, which yield higher profits (Shane 2003; Yu 2001). Similarly, it has been argued that uncertainty prevails in markets, which implies that certain individuals might have a superior ability to build expectations and possess a superior or more accurate vision of the future; i.e. possess a superior perceptive ability.

Further to absorptive capacity and cognitive capabilities, creativity is one of the most prominent individual characteristics mentioned in the context of the entrepreneurial mind. It is often seen as a cognitive capability as well (Shane 2003), although, as will be discussed later, the concept itself is rather fuzzy (see chapter III.C.2). However, creativity is often invoked in explaining opportunity identification, a circumstance that might be traced back to Schumpeter (1934), who introduced the concept of creative destruction in this context. Thus, it is no wonder that researchers tried to model the process of opportunity identification as creativity in economic settings.

As a capability, it is hypothesised that creativity promotes the creation of new means-ends frameworks, which might be equal to an opportunity, and that it helps in finding solutions to problems (Hills et al. 1997; Shane 2003). Indeed, empirical evidence suggest that entrepreneurs are typically creative (Shane 2003); although it is questionable if some scholars, such as Kirzner, would subscribe to that statement since it is not necessarily the case. Creativity seems - equally to intelligence - helpful in finding more valuable opportunities. It could be argued that a creative individual recognises more opportunities than a less creative one. Given that both choose the subjectively most valuable opportunity, it is likely that the creative individuals discover a more valuable on (Shane 2003). The argument stating that creative individuals per se have a higher ability of recognising opportunities is questionable: Even if entrepreneurs are somehow creative or nonconformist, that is a positive correlation between creativity or a nonconformist attitude and the tendency to start a business exists, this does not necessarily mean that they have a superior capability of identifying entrepreneurial opportunities. This is because the decision to start a business is influenced by many factors; for instance, it could be argued that creative or nonconformist individuals attach a high value or utility to being self-employed instead of working in an organisation or hierarchy, thus, increasing the likelihood to start a business. This does by no means necessarily imply that they have a superior ability to recognise opportunities. This is again a problem that arises from referring to venture creation in investigating opportunity identification.

Summarising this body of literature it can be stated that the two major categories identified to play a role in opportunity identification resemble to the two main cognitive categories that will be introduced in detail later in this work. Once again, this justifies the conjecture of a cognitive perspective on the phenomena as a general framework. However, rather implicitly the heterogeneity and controversy in this field of research can be to a huge extent attributed to different metaphysical or ontological foundations underlying the models. Some authors even claim that the fundamental controversy among scholars who study entrepreneurial and organisational environments has focussed on the question whether environments are best understood subjectively or objectively (Gartner and Shaver 2004). Therefore, the following chapter will deal with ontological and epistemological foundations of social sciences and the implications the chosen stance of the present work has for modelling economic action.

As should be evident by now a theory's ontological foundation has significant influences on a model of economic action. The previous considerations should have made clear that it is particularly the human that is at the core of theorising in entrepreneurship research, and that the underlying philosophy in modelling such is of the highest importance: Some authors even claim that the fundamental controversy among scholars who study entrepreneurial and organisational environments has focussed on the question whether individuals and environments are best understood subjectively or objectively (Gartner and Shaver 2004).

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[i] A vivid example is given by a student who reported in the second questioning that he was relaxing in his room in the dormitory and all of a sudden a girl ran down the floor screaming that the space shuttle had exploded. In fact, one day after the incident he declared that he was sitting in the refectory, when he heard of it (Neisser and Harsch 1992).

[ii] Dominance demands that if prospect A is at least as good as prospect B in every respect and better that B in at least one respect, then A should be preferred to B by the decision-maker. Invariance requires that the preference order between prospects should not depend on the manner in which they are described. In particular, two versions of a choice problem that are recognised to be equivalent when shown together should elicit the same preference even when shown separately (Kahneman and Tversky 1984).

[iii] "The analysis of market processes is able to exploit the insight that participants do not merely react to given market data, but rather display entrepreneurial alertness to possible change in these data – an alertness which can be used to explain how such changes can occur in general." (Kirzner 1973, p. 39)

[iv] "But closely as the element of knowledge is tied to the possibility of winning pure profits, the elusive notion of entrepreneurship is, as we have seen, not encapsulated in the mere possession of greater knowledge of market opportunities. The aspect of knowledge which is crucially relevant to entrepreneurship is not so much the substantive knowledge of market data as alertness, the 'knowledge' of where to find market data." (Kirzner 1973, p. 67)

[v] He says that "[…] a true opportunity does not need boldness and leadership to shoulder the risks. If it does, then the entrepreneur has in fact not yet really discovered an available, attractive opportunity for innovation. If the entrepreneur has not seen that opportunity in so shining a light that it drives him to its implementation in spite of the jeering skepticism of other, and in spite of the possibility of is ultimate failure – then the entrepreneur has not really 'seen' that opportunity." (Kirzner 1998, pp. 14-15)

[vi] "We need to remember only how much we have to learn in any occupation after we have completed our theoretical training, how big a part of our working life we spend learning particular jobs, and how valuable an asset in all walks of life is knowledge of people, of local conditions, and of special circumstances." (Hayek 1945, p. 322)

[vii] This holds true for the moment. At a later stage in this work it will become more apparent that, due to ontological reasons, the nexus is not seen between an individual and an opportunity, but between an individual and an economic situation, probably producing an entrepreneurial opportunity.

[viii] "The entrepreneur was not immediately interested in meters, cars, or vending machines as businesses to enter; rather, they represented his known set of potential uses of his technology solution. This strong interference process enabled the entrepreneur to know in advance most of the likely new application for his technology and where he ought to be looking for information channels in the future to know how to commercialise them." (Fiet et al. 2004, p. 18)

[ix] "Actors do not behave or decide as atoms outside a social context, nor do they adhere slavishly to a script written for a particular intersection of social categories that they happen to occupy." (Granovetter 1985, p. 487)

"It (Economics) has tried for a precision, certainty and reach of prediction whose basis is not there." (Shackle 1972, p. 360)

III. Human Thinking

So far, the present work has outlined that the creative element of the human mind promises some explanatory power in explaining why some individuals detect entrepreneurial opportunities whereas others do not. In order to model and investigate such creative thinking three central issues are addressed in the following:

To begin with, the scientific treatment of human thinking is briefly outlined in part A of this chapter. It starts by discussing central definitions of human thinking and cognitive psychology. Many research attempts in cognitive psychology conceive human thinking as solving a problem, an approach that is presented in the second section 2 of part A, which concludes with remarks on the dominating account of cognitive psychology, the information-processing paradigm.

Given this basic scaffolding, the human mind modelled as a problem-solving information processing system (IPS) is presented in the beginning of part B. The basic units on which reflected human behaviour, explained from a psychological perspective, is executed are meaningful knowledge structures that are introduced related to the general conceptualisation of human memory in the second part. An often discussed and cited approach to model such knowledge structures in the human mind is to view them as schemas or mental models of the external world, providing us with the topic of the final section of part B.

It has been shown in the previous chapter II that the notion of opportunity recognition embraces the conception of novelty and newness: Hence, the final part of chapter III is dedicated to the treatment of creative thinking from a cognitive perspective. After defining and demarcating creativity's meaning in the present work in section 1, cognitive processes that are attributed to be important in producing novel outcomes are sketched in section 2. As the final section of this part C will show, such research has revealed sets of individual and contextual variables that help in explaining individual differences in creative thinking; the former set, concerning individuals, contains the influential concept of cognitive styles that will serve as distinctive feature for individuals in the present investigation on the ability of opportunity recognition.

A. Human Thinking and Cognitive Psychology

1. Defining Human Thinking and Cognition

Thinking is a frequently used term that is used as much in everyday-life as in scientific discussions. Thus, it could be distinguished between a non-psychologists notion of thinking considering all intelligent cognitive activities, or an academic psychologist's definition of thinking including only the most complex forms of cognitive activities, such as representation and categorisation, deduction, induction, problem-solving, creativity, wisdom, decision making, etc. (Ericsson and Hastie 1994). Given this somewhat general notions, a vast number of possible definitions and understandings of thinking could be mentioned, in particular highlighting these different notions of psychologists and laypersons. However, the probably most important difference for the purpose of a study like the present is the anti-empirical attitude of many people towards thinking or at least parts of it. They regard it as an ineffable spiritual aspect of our existence, in contrast to the mechanistic and material aspects of our physical environment.

Many scholars have concluded that the nature and structure of thought could never be investigated with intersubjective (objective) methods or even described by general laws and mechanisms (see the discussion in chapter II.A.3). Notwithstanding, the behavioural sciences find such empirical results and it seems that at least a dim light can be shed on the human thought. Nevertheless, critics still object that the phenomenon studied in the laboratory produces artificial outcomes, in particular because frequently used methods as self-observation and introspection lead to serious deficiencies (Ericsson and Hastie 1994). Indeed, in order to completely account for thinking in all its facets research must consider the complexity and diversity of adult thinking and must include the context of accumulated knowledge and skills acquired by an individual over a lengthy developmental experience. Consequently, the topics related to the term of thinking are almost innumerable and approaches to thinking are widely different (Garnham and Oakhill 1994).

Therefore, it will only be given a broad preliminary definition of thinking, which will be elaborated on in the upcoming considerations: "Thinking is the systematic transformation of mental representations of knowledge to characterise actual or possible states of the world, often in service of goals.” (Holyoak and Morrison 2005, p. 2) In the discipline of psychology, most contemporary scientific contributions to the issue are made from a cognitive perspective. This becomes evident in considering that cognition basically means simply knowing about something; thus, it is the act of knowing (Styles 2005); referring to the same phenomena as the preliminary definition of thinking given before. However, becoming more precisely, “[…] the problem of perception and cognition understands how the organism transforms, organises, stores, and uses information arising from the world in sense data or memory.” (Carterette and Friedman 1994, p. XV)

Another very famous and often cited definition of cognition is given by Neisser (1967). He stated that “[…] cognition refers to all the processes by which the sensory input is transformed, reduced, elaborated, stored, recovered and used. It is concerned with these processes even when they operate in the absence of relevant stimulation, as in images and hallucination. Such terms as sensation, perception, retention, recall, problem-solving and thinking, among many others, refer to hypothetical stages or aspects of cognition.” (Neisser 1967, p. 4) But even more important, Neisser goes on and says: “Given such a sweeping definition, it is apparent that cognition is involved in everything a human might possibly do; that every psychological phenomenon is a cognitive phenomenon. But although cognitive psychology is concerned wit all human activity rather than some fraction of it, the concern is from a particular point of view.” (Neisser 1967, p. 4)

This statement refers to the twofold nature of cognition stating that, basically, two main kinds of cognitive elements are dealt with (Mumford et al. 1991): Firstly, knowledge in organised sets of facts and principles pertaining to the characteristics of objects lying in some domain (Chi et al. 1982; Fleishman and Mumford 1989), and, secondly, the cognitive processes contributing to effective application of extant knowledge structures in solution generation (Sternberg 1986a). Since it is uncontroversial that cognition features these two basic elements, the cognitive processes and the knowledge on which they operate, researchers intend to explain individual differences by focussing on (1) the amount, structure, and accessibility of task-relevant background knowledge, and (2) learned strategies or algorithms for utilising internal (from long-term memory) and external (sensory inputs from the task environment) information to generate new states from current states (see Figure 8).

(1) Task-relevant knowledge	**(2) Learned strategies or algorithms**
Amount	Internal information
Structure	External information
Accessibility	

Figure 8 Individual Differences in the Information Processing Paradigm.

If, in general terms, cognition is the act of knowing, consequently cognitive psychology is the branch of psychology that deals with understanding how it is an individual came to know about things (Styles 2005). The task to trace the boundaries of cognitive psychology within the whole field of psychology is difficult since both, its content and its general approach, must be specified. The subject matter of cognitive psychology is quite evident as we consider the definitions given above: in the most general terms it is how the mind works. But in order to keep the subject matter comprehensible and manageable, most scientists clearly focus on higher mental process, including memory, perception, learning, thinking, reasoning, language, and understanding (Lachmann et al. 1979). Within such research on cognitive psychology it is possible to identify major research streams. For instance, Eysenck and Keane (2000) differentiate four such streams: (1) Experimental cognitive psychology that stays in the experimental tradition of cognitive psychology without computer modelling, (2) cognitive science, which is developing computational models in order to understand human cognition,[x] (3) cognitive neuropsychology that studies patterns of cognitive impartment shown by brain-damaged patients to gain information about normal human cognition, and (4) cognitive neuroscience, which uses several techniques for studying brain functioning (e.g. brain scans) (Eysenck and Keane 2000).

However, irrespective of the stream research on human thinking has the aim at explaining human behaviour in a given situation. Scholars had to find a way of conceptualising human thinking in particular situations: In this regard, a widespread thesis in cognitive psychology is that all cognitive processes can be principally understood as problem-solving process (Anderson 2001). The main argument presented states that human cognition is always purposeful, in the sense of reaching an end and removing obstacles, which stand in the human's way (see Köhler's (1917) famous experiments with the ape Sultan). In the present work, economic action, and in particular creative economic action named opportunity recognition, is modelled or thought of as a problem-solving process. In order to point out how such a perspective views human thinking and how this also holds true for economic settings, the general notion or perspective of problem-solving is introduced in the following paragraphs.

2. Problem-Solving

Generally, whenever an individual generates a new idea that proves useful in addressing certain social (or economic) needs, it has constructed and implemented a course of action - one out of many potential alternatives - which has brought about the attainment of a certain goal state (Mumford et al. 1994). Since the beginnings of research on thinking as problem-solving until know the broad notion or definition has not changed: It is the situation in which an organism has a goal but lacks a clear or well-learned route to its achievement (Dominowski and Bourne 1994). Accordingly, an individual or human being is regarded as a problem-solver. Typically, three characteristics are mentioned, which define a particular process or action as problem-solving: (1) The mentioned purposefulness of action, (2) the dissection into sub-ends and (3) the application of operators (Anderson 2001).

However, many ideas relevant to problem-solving, e.g. that of sets, have also been found important in economic settings, referring to concepts such as framing (see chapter II.A.2). Since the present work deals with such an economic topic another differentiation might be important in order to delineate the present field of study: the difference between problem-solving and decision making. Abundant literature in microeconomics deals with the decision making processes of economic agents (see for an overview Eisenführ and Weber 1999); however, these treatments are different from the present in the sense that problem-solving is understood as the process of designing appropriate courses of action and evaluating them. The subsequent choice between such available options is regarded as decision making (Sternberg et al. 1986). As Figure 9 points out problem-solving is a wider concept in a way including the steps of decision making, which are highlighted within the process.

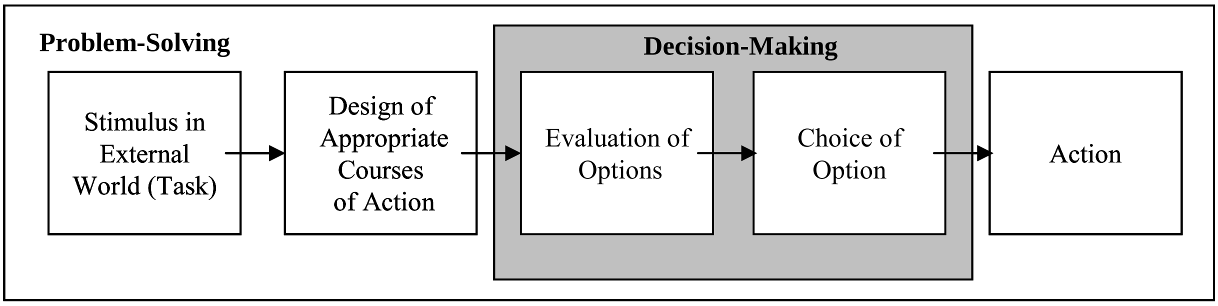

Figure 9 Problem-Solving vs. Decision-Making.

However, although there exist many different approaches to problem-solving in more recent cognitive psychology for understanding and assessing it (Bejar et al. 1991), they all share the conjecture that it makes sense to dissect the overall end in sub-ends, because in many stages of such a process operators are known to the acting individual, which enables it to complete sub-ends (Newell 1980). Here, the term operator denotes an action that transforms the present problem state into another state. The solution of the whole problem is a sequence of such known operators (Anderson 2001). In modelling such processes, some researchers examine the use of knowledge structures in problem-solving (e.g. Chi et al. 1989; Kulkarni and Simon 1988), while others rather focus on the processes that operate on such knowledge (e.g. Hayes and Flower 1986; Sternberg and Lubart 1991). But again all these approaches to problem-solving are based on a general notion of thinking as a process, which will be briefly outlined hereafter.

Before outlining a general process of problem-solving some remarks should be given concerning many problem-solving models and their underlying ontology. Exemplary Herbert Simon and his influential works (e.g. Newell and Simon 1972; Simon 1979) on problem-solving ought to be mentioned; his models adhere to formal-analytic principles and start with a space of potential possible actions. Therefore, such individuals are programmable and only restricted by their bounded rationality, which focus on satisfycing as central principle of behaviour. As shown in chapter II.A.2 such models exclude endogenous novelty and creativity introduced by humans. Consequently, the present work, while seeing human thinking as problem-solving, conceptually dissociates from such exact models of problem-solving for investigating creative human thinking in economic settings. Supporting such an ontological stance, finally even Herbert Simon - probably the most famous pioneer in this field - had to admit that in such programmed models, active thinking has been done by the designer of the machine and by those who use it. Creative thinking is therefore not to be found in the machinery itself (Brillouin 1968).

Coming back to the general idea of conceptualising problem-solving as a process within the theoretical boundaries of cognitive psychology is often attributed to Newell and Simon (1972), who were the first to introduce and specify specific problem-solving strategies. Similarly, the work is often regarded as path-breaking in terms of providing a basis for process-analytic models, including the importance of domain-specific expertise in process application (Mumford et al. 1991). Since then, a huge variety of process models has been developed that distinguish different phases; however, they all assume quite similar underlying processes, also including the notion that on a sufficiently abstract level, the efforts necessary to solve a problem are most basically always the same.

In an attempt to provide a general model, Wessells (1994) identified four successive steps, which are closely interacting throughout the whole process. The first step is the (1) definition of the problem, including a description of the starting situation or starting point and the target situation or end. Very often, this first step of problem finding is crucial to the success of the whole process; e.g. scientists spend a significant part of their time with formulating problems in order to design a well-formulated question (Klahr 2000). The second step involves the (2) setup of an adequate strategy, method, or plan. Apparently, individuals employ large numbers of different strategies, ranging from primitive methods, such as trial and error, to cleverly devised scientific methods. The third step, the (3) execution of the strategy is very often rather simple or trivial, as long as the problem solver is dealing with simple and well-defined problems. Poorly-defined problems often bear an inherent dynamic, hindering the use of fixed strategies and forcing individuals to deploy feedback loops. The fourth and last step consists in the (4) evaluation of the progress as to the target area or end. The decision has to be taken, whether the problem is solved or a progress has been achieved towards the target or not and, consequently, the current strategy should be retained or be adjusted. This is the most important loop position in the process, particularly in case of inappropriate strategies, which lead again to previous steps of the process (Wessells 1994).

Terminologically, the whole thinking process outlined above will be called problem-solving in the broader sense, consisting of problem finding and problem-solving in the narrower sense. Evidently, the mental construction of a problem and the process of conceiving a solution to it - problem-solving in the narrower sense - are highly associated with each other and a lot of aspects can and should be mentioned in connection. Between problem finding and problem-solving a functional relationship exists and very often problem-solving efforts are dependent on problem finding efforts and vice versa. Furthermore, it has already been mentioned that in real terms there exists no clear-cut distinction between discrete stages, thus, neither for problem finding and problem-solving. In other words, it is difficult to establish a border between these two terms since they are highly interactive and share a lot of characteristics. Nevertheless, they are now briefly outlined independently, in order to provide the reader with a general notion of what is meant with the terms.

The term of problem finding describes a family of behaviours and processes, among them problem construction, problem discovery, problem expression, problem posing, problem definition, and problem identification, depending on the underlying notions of the particular model at hand (Runco 1994). Although there are many differences that could be thought of, they can all be seen as a process resulting in a problem to solve (Dillon 1982). Some authors remark that, according to the type of problem that is dealt with, it is not always appropriate to use the term of problem finding, for not only some solutions, but also problems in real-life are sometimes discovered serendipitously (Mednick 1962; Wolf and Larson 1981).

However, most generally, problem finding involves recognising the problem existence, finding gaps, inconsistencies, or flaws with the current state. Arlin (1976) proposes three main elements that must be included in a definition of problem finding: (1) The existence of a problematic situation, (2) an opportunity for individuals to raise questions, and (3) a way of categorising the questions once they are raised. Sternberg (1985) devised a two level description of problem finding, starting with the discovery of a problem area or topic, which is followed by the structuring of the problem as preparation for solving efforts (Rossman 1931; Sternberg 1985). Some authors suggest distinguishing problem finding, problem posing, and problem construction. Here, problem finding is the notice of something is not right, not good, or lacking; problem posing refers to the expression of such a situation; and finally, problem construction describes the development of a detailed problem representation (Lubart 2001). However, focussing on finding a problem, several experiments on syllogistic reasoning revealed that humans really base their behaviour rather on experiences and attitudes than on logical rules (see e.g. Frase 1968; Henle 1962). Even in the most extreme theoretical case, creation ex nihilo (creating something from nothing), the problem finding process does not arise in a vacuum, but rather operates on a kind of raw material: on knowledge.

Accordingly, one option is to view this process as problem construction referring to a recursive memory search used to generate hypotheses that might account for, or structure the, available information. Subsequently, the adequacy of the problem construction is tested by the degree to which these hypotheses are consistent with available data (Mumford et al. 1991). In some way, problem constructions derive from knowledge obtained as part of prior problem-solving efforts (which can be anything, not explicitly recognised as a problem-solving effort by the individual). Such a model clearly stresses the role of active, conscious information processing in problem-construction. Here, the terms of hypotheses and their testing suggest that problem constructions provide a plan or framework for solution generation and implementation (Mumford et al. 1994). Apparently, it should be easier to solve a problem if it is represented in such a way that the decisive operators can be deployed (Anderson 2001).

Expressed differently, some problem representations are better than others in the sense that they result in better or more rapid solutions (Hayes and Simon 1977).

Research on the differences in efforts of experts and novices has revealed that one extremely important variable influencing the quality of available problem representations is expertise (see e.g. de Groot 1965; Kay 1994; Hayes and Simon 1977; Kotovsky et al. 1985; Simon and Hayes 1976). It is hypothesised that experts have more relevant representations available and their organisation is based on underlying principles, which seem to facilitate the selection of appropriate representations (Gick and Holoyak 1983). Irrespective of any qualitative aspect, it has already been hinted at the subjective nature of an individual's knowledge; this is of particular importance in this regard since an individual subjectively constructs the problem at hand: Even in a presented problem situation people construct an idiosyncratic subjective view and do not all equally respond to the same stimulus (Kay 1994). In other words, the individual subjectively constructs his own problem space (his problem representation) offering him options from which he draws his actual behaviour (Newell and Simon 1972). At the latest by now, the reader should realise that this notion involves the subjective construction of reality, so controversially discussed in psychology and philosophy (see chapter II.A.1), and here named principle of cognitive creation.

As already outlined in the basic model of human action in time, when an individual has come to a problem representation (through the process of cognitive creativity) his efforts are directed towards finding solutions; this is called problem-solving in the narrower sense. Research in that field of problem-solving (in the narrower sense) has identified a variety of possible strategies individuals apply to find a solution to the problem at hand. These could be defined as "[…] executive, higher-order processes that supervise other cognitive operations." (Houtz 1994) Very often, strategies are attributed to experts who have specific ones since their application seems to be linked to expertise. Generally, the planning of an effective strategy requires the deployment of knowledge about task type or task environment and task difficulty, about probability of success, and about the characteristics of the problem solver (Wessells 1994). In this respect, it is important to distinguish between common strategies, which can be applied to all task environments, and specific strategies that only allow the problem solver to make progress in one or a limited number of specific task environments. However, due to the impressive number and variety of deployed strategies by adults in solving problems, only a few categories, which cannot be clearly distinguished and partially overlap, are identifiable.

A general classification, according to the degree of generality of the method of solution, could divide strategies in algorithms and heuristics: An algorithm is a method, which always solves one type of problems, even if the problem solver is not conscious of how the method functions. A correctly applied algorithm guarantees the correct answer. A heuristic resembles to a rule of thumb, which cannot ensure the correct solution of the problem. In games a good strategy never guarantees victory, the application can only increase the probability of a welcome outcome (Wessells 1994). Intuition already suggests that individuals rather apply heuristics in most real-world problem-solving.

Being more specific, a huge number of problems, so called transformation problems (see Greeno 1978), consist of a starting or initial situation, a target, and a group of operations, which are used to arrive at the end starting from the initial situation. The heuristic of the means-ends analysis is then applied to identify the principal differences between the initial and the aspired situation as well as the actions or means, which reduce them. Such a differences-reducing strategy is very useful in solving ordinary problems, such as avoiding heat loss in the winter or the famous thinking task of the Tower of Hanoi (Newell and Simon 1972). The means-ends analysis is only applicable if the problem has a clear defined end structure, which can e divided in sub-ends. Indeed, several studies suggest that subjects identify sub-ends and concentrate their resources on the gradual completion of those (see Egan and Greeno 1974; Simon 1979). It is assumed that one of the most significant advantages of such a strategy consists in reducing complexity: by defining sub-ends and by planning the means to complete them, an individual's limited cognitive capacities can be considered and mistakes or inappropriate simplifications be avoided (Wessells 1994). However, searching activities have found to be the dominant aspect of problem-solving (in the narrower sense). For instance, in executing a means-ends analysis the individual searches for the optimal procedure in order to reduce the discrepancy between the current and the desired state (Wessells 1994). Searching and planning usually go along hand-in-hand, because planning includes a choice between options, which have been identified by a previous search for alternatives. Thus, a good method to improve planning and problem-solving capabilities is to learn, how to search explicitly and thoroughly.

Again, it is quite apparent that there exists an almost innumerable variety of conceivable searching strategies. However, research on this topic has been able to identify some common searching strategies often used by subjects in laboratory thinking tasks, for example the strategy of generating and testing of solution, analogy thinking, or constructive search (see for instance Anderson 2001; Eysenck and Keane 2000; Greeno 1978; Sternberg 1977; Wessels 1994). The reader might have already realised that the conception of thinking as problem-solving highly resembles to the model of human action in time. Figure 10 is supposed to underline this high degree of similarity.

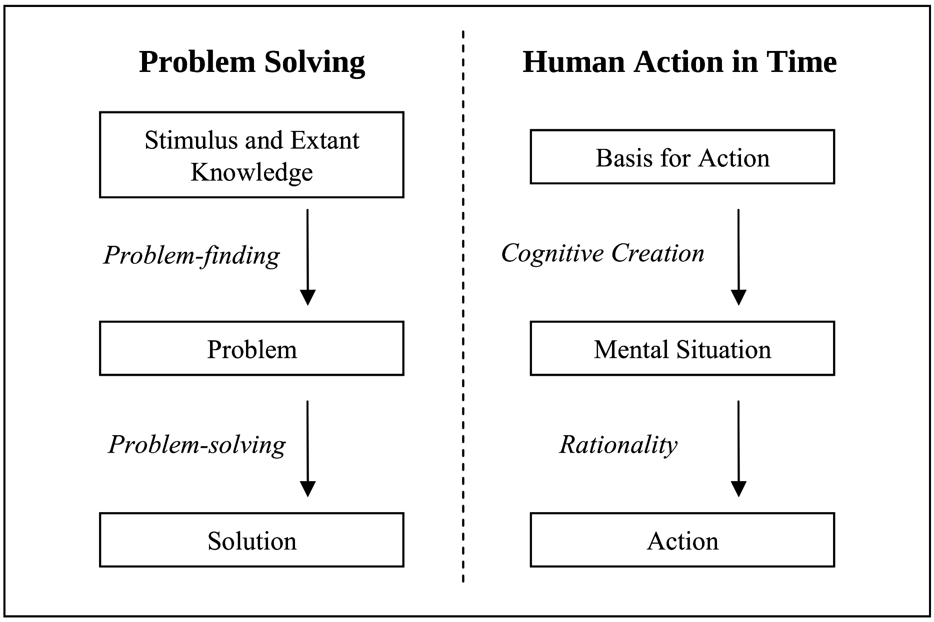

Figure 10 Problem-Solving and Human Action in Time.

The approaches differ in that problem-solving models are more precise in distinguishing between finding a problem and finding appropriate solutions or reactions to it. The model of human action in time embraces these aspects in the mental situation, containing the problem to solve and possible actions to be taken. However, drawing on the similarity it can be argued that the central topic of the present work can be seen in the cognitive processes leading to a problem representation and the respective solutions or options of actions. Therefore, the following paragraphs are dedicated to the nature of such problems and subjective representations.

In relevant literature there is no agreement as to the nature of a problem: Some researchers regard it as an obstacle (Runco 1994) or just trouble (Hill 1988); again others see a problem equal to a challenge (Runco 1994). However, in the broadest terms, a problem is a gap, an inconsistency, or a flaw an individual recognises in the current state and wants to be transformed into a workable problem (Henle 1974; Runco and Dow 1999). In other words, “[t]he term problem is conceived broadly as any task that an individual seeks to accomplish. Thus, artists who seek to express their feelings, scientists who seek to understand a complex phenomenon, and people who seek to solve conflicts in their everyday lives are all considered to be engaged in problem-solving." (Styles 2005, p. 297; see also McClelland 1965) Assuming this broad view of problem-solving on thinking, the problem represents the interface between the two basic processes of problem finding and problem-solving: The output of the problem finding process is the problem, which serves as input for the subsequent problem-solving process.

The question is now, which prerequisites must be fulfilled so that it can be said an individual faces a problem? What must be included in the constructed mental model or integrated set of hypotheses describing the problem, allowing individuals to structure ill-defined or novel situations finally leading to the generation of viable problem solutions? These specific mental models are called problem representations: To have a problem in this sense implies (at least) that crucial information about the situation is given to the problem solver; this means an individual comes to a subjective internal representation of this situation in the external world in mind. In other words, a problem representation is an ad hoc-category constructed to capture the central features of the present situation in comparison to prior problem-solving efforts (Holoyak 1984).

In general, insights from research in cognitive psychology on other (general) knowledge structures can be (at least) partially transferred to problem representations (Hogarth 1980). Nevertheless, it is subject to discussion, which information must be included in such workable problem representations or mental situations, on which subsequent thinking efforts can be based. For instance, Newell and Simon (1972) assume in their path-breaking work on problem-solving that it comprehends (1) information about what is desired, (2) under which conditions, (3) by means of what tools and operations, (4) starting with what initial information, (5) and with access to what resources (Newell and Simon 1972). According to Holyoak (1984), these representations include information about (1) important diagnostic facts, (2) goals, (3) procedures used in problem-solving, and (4) constraints or restrictions on the problem solution. Similarly, Mumford et al. (1991) distinguish between (1) goals, (2) constraints, (3) outcomes, (4) key steps in solution, and (5) essential declarative information. However, it should be mentioned that individuals use these representational elements in a flexible, dynamic manner as they attempt to structure and solve novel, ill-defined problems (Novick 1990; Reeves and Weisburg 1994).

Irrespective of a particular configuration of aspects that are necessary for a complete problem representation, two main issues should be underlined for the purpose of the present work: Firstly, researchers in the field of cognitive psychology focus on types of information and not on particular information included, which avoids the ontological and epistemological problems in a constructivist paradigm by targeting general characteristic of situations that can be regarded invariant. Secondly, the term of problem is used in a wider sense than it might suggest in a first moment since it is a complete account including means and ends to achieve the former in a given situation..

While former efforts to explain problem representations hypothesised that an analogous problem representation from a previous situation is selected and then used to define the problem and to structure the ill-defined domain, recent, more realistic research argues that people may instead apply them in a more flexible manner focussing on different components of various extant problem representations. Thus, a subject might apply a representation based solely on similarity in key operations or procedures used in solving the problem, rather than overall analogical similarity involving key objects or information (Novick 1990). Thus, it seems to be more realistic to assume that individuals deal with a set of representations, which is pertinent to a given problem situation. This is what Newell and Simon (1972) called the problem space. These multiple problem representations are likely to be organised based on substantive similarity and associational networks. If it is assumed that problem representations are used flexibly this might also imply that stimuli activate multiple problem representations, even in new or unfamiliar domains.

However, a more detailed discussion of the cognitive processes at work is presented in chapter IV.C.1 At this point, the processes to gain separate representations for specific cases of problems are ignored and rather archetypical taxonomies for larger classes of problems introduced. However, the problem finding or problem-construction process' importance for the whole problem-solving effort is not similar in all situations an human being is facing; it rather depends on the type of situation the individual is confronted with in its task (or in real life). To distinguish between such situations, and also to clarify the impact of the problem-construction effort, several taxonomies of problems or problem situations have been introduced.

Most generally, different problems could be seen as different kinds of gaps identified by individuals, which lead to question raising, evidently fundamental questions. Such a classification could be done according to size, to their location within a realm of the unknown, or to attractiveness (Henle 1974). However, during the last years some agreement has arisen as to problem taxonomies accounting for typical differences in problem situations. Consequently, a lot of such taxonomies according to the complexity of the task have been introduced, which are quite similar, at least in their underlying notions: Sternberg (1982) introduced the terms of well-defined and ill-defined problem spaces, building on the notion of the problem space, the extrinsic task environment in which mental processes take place (Newell and Simon 1972). Accordingly, a broad classification of problems would distinguish between well-defined and ill- or poorly-defined problems. A well-defined problem has an identifiable starting point and an unambiguous end. Contrary, a poorly-defined problem has neither a clear starting point nor a target area. A good example for the latter kind of problems are all creative tasks, which cannot be measured by normed instruments and, thus, success in solving the problem is extraordinary difficult to evaluate (Wessells 1994).

If the mentioned distinction is seen as a dichotomy put on a continuum, the two extremes would be a presented-problem situation in well-defined settings and a problem finding situation in ill-defined settings. This approach is based on Wertheimer (1945) and Getzels (1964), who distinguished between presented problem situations and discovered problem situations. In the former case, only a problem-solving thought process (in the narrower sense) is required. Furthermore, in this extreme case there already exists a recognised solution and a specific method to obtain it. This was also described by Wertheimer (1959), who understood a presented problem as a problem solved by recall or mechanical thinking, i.e. by standard procedures. In the latter case of problem finding situation, the formulation of a problem prior to actions has to be realised. There exists no known formulation and no consistent or recognised method of solution. This means that method and solution are highly shaped by the initial parameters set by the individual during the problem formulation (Sobotnik and Moore 1988).

These two extremes open a range in between numerous possibilities can exist. This distinction could be seen analogous to the distinction Hesse (1990) makes in his model between rather mechanical thinking efforts and conscious, reflective ones, which - from this perspective - are induced by the necessity to structure the problem situation at hand. However, Frederiksen (1984) recapitulated the dichotomy of well and ill-defined problem situations, describing the former as those, which are clearly formulated and having a known algorithm of solution, and criteria available for testing the solution, while the latter are assumed to miss all these variables. Yet another classification distinguishes between situations of problem identification and problem finding (Runco and Okuda 1988). The former term refers to ideational productivity in the process what is here called problem construction, but the problem definition is already presented to the individual. The latter case describes a situation, in which both ideational productivity and the ability to define a workable task in subsequent problem-solving efforts are necessary (Runco and Okuda 1988).

In addition, Dillon (1982) identified three problem types or situations based on the problem discovering task and the materials used to elicit inquiry strategies: (1) potential problems raised by individuals from non-problematic materials, (2) implicit problems, embedded in problematic situations, and (3) evident problems presented to individuals (in particular by researchers to provoke a problematic response). The noteworthy aspect of his account is that Dillon suggests a dynamic notion, assuming that problems develop from unformed to formed along a continuum. The fully unformed problem must be found in order to be formed: All problem-solving efforts start from this point of formed condition (Dillon 1982). By now, it should be clear that the placement on such scales or dichotomies is highly subjective since individuals have different background knowledge and experience, similar to aspects such as knowledge.

An often cited classification, which is presented here in some more detail since it accounts for most of the mentioned aspects, in particular the subjective nature of problem representations, has been developed by Getzels and Csikszentmihalyi (1976). In their approach it is emphasised that, while all problem situations are similar in that they involve the same elements (formulation of problem, adoption of a method of solution, and reaching of solution), they differ in the circumstance that the individual confronted with a problem has to discover or construct these structural elements, or simply adopt already available ones. In this concept, three types of problems can be defined: (1) presented problems, (2) discovered problems, and (3) created problems. A problem is considered to be presented if its salient characteristics are defined by others. It is referred to a discovered problem, if it is derived from information presented to an individual. Finally, if an individual generates a problem, where none has existed before and it defines the nature of the problem and pertinent information, it is called a created problem (Dillon 1982). Therefore, the additional aspect that the problem situation might be inter-subjectively new or only subjectively new to the individual at hand is included; it is important to note that this exactly corresponds to the subjective nature emphasised in chapter II.B.2.

Consequently, regarding this subjective nature such approaches have in common that "[…] the creative process is seen as a response to a problematic situation. Therefore the main elements of creativity, as of other problem situations, are the formulation of a problem, the adoption of a method of solution, and the reaching of a solution. But while all problem situations are similar in that these three structural elements are present, they differ from one another depending on whether the person confronted with the problem has to discover a formulation, a method, and a correct solution, or simply adopt already available formulation, method, and a correct solution, or simply adopt already available formulations, methods, and solutions." (Getzels and Csikszentmihalyi 1976, p. 79)

	Problem		Method of Solution		Solution		Cognitive Functions Primarily Engaged
Problem Situation	Others	Individuals	Others	Individuals	Others	Individuals	
Type-case 1	+	+	+	+	+	-	Memory
Type-case 2	+	+	+	-	+	-	Reason
Type-case 3	-	-	-	-	-	-	Imagination
Note: + known; - unknown							

Figure 11 Types of Problem Situations and Cognitive Functions (Getzels and Csikszentmihalyi (1976), p. 80).

The classification of Getzels and Csikszentmihalyi (1976) is depicted in Figure 11. On the one hand, at on extreme, there are presented problem situations in which the problem has a known formulation, a routine method of solution, and a recognised solution; individuals only need to follow established steps for reaching the solution in the situation (type-case 1). On the other hand, at the other extreme, there are discovered problem situations in which the problem does not yet has a known formulation, a routine method of solution, or a recognised solution; individuals must find the problem and the requirements for satisfying the situation's requirements themselves (type-case 3). Individuals have no chance to find any hint from others; they must become problem finders before becoming a problem solver: They must pose the problem before directing attention to a way to solve it and thus, reaching the solution (Getzels and Csikszentmihalyi 1976). The interesting point about this latter situation is that the individual cannot know whether the solution is right or wrong since he himself formulated the problem; accordingly, assuming a constructivist position, the solution can only be accepted or rejected on the basis of a critical, relativistic analysis (Getzels and Csikszentmihalyi 1976). These two extremes mark the range in which a number of problem situations could be systematically assigned to, according to what is known and unknown. In-between, type-case 2 differs from type-case 1 in that only the problem is given from an individual's perspective: Although others are aware of all three aspects of the situation, the individual has to find a method of solution and the solution itself.

Further to these general considerations, the corresponding typical mental processes can be inferred for each situation, indicating the typical degree of creativity involved. The differentiation between the individual at hand and others is included in order to show, whether a particular individual in a particular problem situation is simply unaware of the problem, the solution, or the method that are known to others, or whether these generally do not exist yet.

The outlined problem situations already point out that the extent, to which an individual must dedicate efforts to problem finding before starting problem-solving (in the narrower sense), highly depends on the type of problem situation and highly influences the degree of creativity involved in the task. Consequently, the notion of problem finding is directly linked to the problem situation at hand. Furthermore, a lot of researchers on creativity have adopted a problem-solving perspective on thinking and intended to explain creative outcomes of thinking through problem finding efforts. Some even draw on such taxonomies to distinguish between problem-solving situations (in the narrower sense) and situations in which creative thought is required. In the latter case the individual must necessarily set the parameters for the following problem-solving efforts on its own. As this research focussing on the role of problem finding in creative thinking suggests, irrespective of a specific classification problem finding becomes a more important determinant of performance as the degree of a priori structuring decreases: “In other words, problem construction has a particularly important influence on creative problem solving in ill-defined domains, where the pertinent goals, pertinent parameters, requisite information, and available solution strategies are unknown or poorly articulated.” (Mumford et al. 1994, pp. 8-9; see also Anderson 1985; Getzels and Csikszentmihalyi 1976; Okuda et al. 1991)

It should be kept in mind that the problem situations mentioned so far are of rather conceptual nature. It has been found that there is only a low correlation between creative performance solving traditional (rather artificial) problems (e.g. the Tower of Hanoi problem) and real-world problems (Okuda et al. 1991). Therefore, they should be seen as what they are: A means to structure the innumerable variety of possible situations in real word that require human reasoning; nothing more and nothing less.

More scientific approaches, aiming at thoroughly investigating the two central cognitive elements, should not be content with a problem-solving perspective. Efforts to explain cognitive processing and knowledge representation have adopted a particular view on ‘technically’ conceptualizing human cognition: human thinking as information processing. Hence, the following considerations are dedicated to a brief outline of this predominant paradigm in contemporary research on cognitive psychology. It will provide the basic instruments for investigating opportunity recognition in the present work. Further to this, the author is convinced that a scientific work that assumes a constructivist approach, like the present, must clarify which perspective is taken, because there is more than just one accurate or correct way to look at a phenomenon even within one scientific discipline, respectively such perspective cannot even exist. This holds also true for psychology, a progressing science, in which many important questions not even have been asked so far, let alone been answered. In such a field, where there exist hardly ignored facts and agreed-upon theories it is important to consider the advantages as well as disadvantages of the perspective chosen. Therefore, and not surprisingly, in psychological research such different paradigms seem to exist (Lachmann et al. 1979).

3. Information Processing

The reason why the information processing paradigm (IPP) is chosen is quite simple and can be best expressed by a citation from the introduction of one of the most popular textbooks on cognition: "We have written this book from the point of view of one particular paradigm: information processing. We do not argue that it is the right way to understand and explain human mental processes, but we believe that it is at the present time the most comprehensive and comprehensible way." (Lachmann et al. 1979, p. 33) In order to provide the reader with an overview on the IPP, it is hereafter briefly defined what a paradigm is. Then, developments in psychology and other disciplines towards an information processing paradigm (IPP) in cognitive psychology are presented along the typical dimensions of a paradigm, and, finally, the paradigm and its fundaments discussed.

The way research is done by researchers can be described by looking at the rational and conventual rules guiding such research. Each scientific research effort follows certain procedures that only just qualify it as science. These rules are well known and publicised and constitute the scientific method that Popper called rules of the game (Popper 1935). The rational rules of science are commonly shared by most disciplines. But every scientist uses a second set of rules which is conventional in the sense that several or many scientists agree that they are appropriate. Every science has such conventional rules, but they are not the same and differ from one scientific discipline to another. Even scholars within a discipline may direct their scientific actions according to different conventional rules. From this point of view, a scientific paradigm exists when a group of scientists share essentially the same conventional guidelines for formulating research questions and structuring experiments to answer them (Lachmann et al. 1979). The reason why this is presented here is that it has to be pointed out, which premises underlie the study of the phenomenon in question, the recognition of entrepreneurial opportunities, and that there exist not only different approaches from different disciplines to study it, but also within a cognitive psychological perspective.

Generally, the question rational rules can answer is that of the distinction between science as an human institution making claims about human nature, and other such human institutions like religion, art, poetry, political ideology, etc. Basically, there exist at least two fundamental differences between scientific methods for the study of mankind and non-scientific methods: Science is the only institution whose ultimate objective is obtaining knowledge for its own sake. It is not prescribed what the truth is, while religion for example, claims a truth that is offered as foundation for prescribing moral rights and wrongs. Science's rational component explicitly precludes the translation of any of its discoveries into prescriptions on the right thing to do. Secondly, whether a theory is to be verified or falsified, the rational component of science always demands that scientific beliefs at some point are tested against observable evidence. That means that in principle, science has no axioms that are sacred and invulnerable to observational test (Popper 1935; Rosenberg 2000).

While rational rules have a more prescriptive character, some rules are more descriptive: conventional rules. This term was introduced by Popper, who regarded methodological rules of science as conventions (Popper 1935). For instance, the canonical, rule-governed component of scientific methods requires that hypothetical accounts of natural-system properties are tested by observation; however, empirical support is a complex and controversial subject. As indicated, the rational rules rather provide hints as to how observe than as to what to observe. The selection decision has to be based on other resources; very often it is the collective wisdom of other researchers in the field (Lachmann et al. 1979). This collective wisdom consists of previous findings and observations, but also, and equally important, on assumptions. Such assumptions might have been indirectly supported, and many scientists in the relevant field might be convinced of their validity, but they have never been validated empirically. In other words, they are rather intuitive commitments of scientists in the field that are not really open to empirical falsification (Flach and Bennett 1996). Even interpretations that are made of experimental data are also influenced by such collective wisdom. Very often interpretations are made without empirical justification:

In psychology for instance, for decades theories on complex human learning have invoked the data of rat experiments, without knowing whether both behaviours are subject to the same basic processes (Lachmann et al. 1979). The point is that in competing paradigmatic views not the data is subject to disagreement but its interpretation, respectively its meaning. Apparently, such paradigms are extremely important to understand research done since facts do usually not speak for themselves.[xi] One of the first who introduced a systematic treatment of developments in research and science was Thomas Kuhn (1962).

Kuhn's approach to the growth of scientific knowledge and the relation to the previously dominant conception of an accumulation model will not be discussed in detail. It seems more sensible to discuss his model of a paradigm: To him, a paradigm includes the intellectual commitments and beliefs of a community of like-minded scientists. It provides problems to the community and defines the domain of acceptable solutions, thereby representing the tacit commitments to a conception of reality that cannot be defended on rational or canonical grounds. His approach to scientific discovery challenged the previous notion of an absolutely rational, thoroughly cumulative and unequivocally objective process. Instead he emphasised the importance of consensual judgements in determining what appears to be rational, objective, and worth cumulating (Machamer 2002). Probably, a paradigm can be best defined by the original definition of Kuhn himself: "[A paradigm] functions by telling the scientist about the entities that nature does and does not contain and about the ways in which those entities behave. That information provides a map whose details are elucidated by mature scientific research. And since nature is too complex and varied to be explored at random, that map is as essential as observation and experiment to science's continuing development. [...] [Furthermore] paradigms provide scientists not only with a map but also with some of the directions essential for map making. In learning a paradigm the scientist acquires theory, methods, and standards together, usually in an inextricable mixture." (Kuhn 1962, p. 109)

Further, scientists communicate frequently and are aware of and cite on another's research, further enhancing this process. However, a possible distinction between paradigms within a science proposed by Lachmann et al. (1979) might consider differences in (1) intellectual antecedents, (2) pretheoretical ideas, (3) subject matter, (4) concept and language of those who adhere to it, (5) preferred analogies, or (6) methods and procedures typically employed. It should be kept in mind that these aspects or dimensions are treated separately for analytical purposes; in fact, they are closely intertwined and each involves the others. However, competing paradigms in a field differ in several ways, although it might be that they only differ in only two or three dimension.

Kuhn’s model has been critiqued harshly, mainly by other philosophers of science (e.g. Lakatos 1970; Popper 1970). Further, the concept of paradigm has been rejected and other suggestions have been made, such as research programs (Lakatos 1970), disciplines (Toulmin 1972) or domains (Shapere 1977). Nevertheless, the concept of paradigm will be used to signalise which basic conjectures are underlying the following chapters and empirical research done; this seems particularly important since the present work is about a phenomenon usually treated by economists, who are not necessarily familiar with the basics of cognitive psychology. In addition, the discipline of cognitive psychology, facing the challenging task of opening the black box of the human mind after a behaviourism-dominated era in its field, is still mainly occupied with the exploration of unknown fields, i.e. basic research. However, the following paragraph is dedicated to the information processing paradigm that is present along a paradigm’s dimensions as mentioned above.

The nature of a science at any given point in time is comprehensible in the context of its intellectual antecedents.[xii] These antecedents, which shape a scientist’s beliefs about his work, can be historic or contemporary. They could be regarded as sources for the scientific work within a paradigm, and are often from another discipline. It is important to emphasise that this issue is a double-edged sword: Kuhn stressed the discontinuous character of revolutionary changes in a discipline (Kuhn 1962), while other philosophers of science highlighted the aspect of continuity (see for an overview Bechtel 1988; Machamer 2002). Generally speaking, a paradigmatic change has several phases and aspects (as can be seen in the distinction of the different dimensions) and does not always follow the same modus operandi. Like in almost any process of change a dichotomy with one end of gradual change and the other of radical or revolutionary change can be identified (Bechtel 1988). Sources of continuity are for instance methodological preferences that prevail within a discipline independent of the paradigm, the training of scientists, who might have shifted to the new approach but still have a fundamental interest on a particular topic, and, finally, some well-established facts, laws, and theories existing in a discipline that are commonly accepted and survive a paradigm shift (Lachmann et al. 1979).

Several fields of psychology have contributed to the IPP’s fundaments, but it was foremost Neobehaviourism who shaped its form: Many methodological principles were adopted from this stream in the information processing account of cognitive psychology, e.g. the goal of attaining nomothetic explanations, i.e. searching for universal theories, or empiricism as its method of proof. Simultaneously, the IPP does reject several fundaments of Neobehaviourism, in particular animal data as a source of basic principles, learning as the central psychological problem, and logical positivism (Lachmann et al. 1979). The stream of Verbal Learning shares many pre-theoretical ideals with Neobehaviourism. Nevertheless, it should be treated differently since it was functionalistic, i.e. comparing mental states to the functional or logical states of a computer (Putnam 1960), producing few major theories (see for an overview Cofer and Musgrave 1961).

Already during World War II new views of the human being appeared, often related to the term of human engineering since the behaviouristic psychology was not really useful in organising military action. Instead, in military psychology the human was conceptualised as an information transmitter, moving the focus of attention to the problems of attention and perception (Chapanis et al. 1947; see for an overview Nemeth and Nemeth 2000). In human engineering, the theory of signal detection was developed to separate perceptual ability from decision making, a further emphasis of this stream, which is still popular in contemporary cognitive psychology (Craik and Lockhart 1972; Lockhart and Murdock 1970; Shettleworth 1998). Hence, information processing in psychology transferred many aspects from human engineering to its field, amongst them the view of man as an information transmitter and decision maker, the idea that the capacity of information that can be transmitted is limited, the theory of signal detectability and an increased access to the concepts of the physical sciences (Lachmann et al. 1979).

However, not only psychology-related fields contributed to the development of the IPP, others were influential as well; for instance, communications engineering, which has the aim at developing general principles applicable to any communication system. However, although these principles are principally designed to describe artefacts like telephones or the Internet, they can be transferred to humans if these are understood as ‘communication channels’. Exactly this metaphor was used by early cognitive psychologists (see Shannon 1948), thereby importing terms and concepts as coding, channel capacity, serial and parallel processing, efficiency, uncertainty, and information into psychology. Many psychologists recognised that information theory, originally developed in communications engineering (Manktelow 1999), provided rich insights into psychological questions, even though it was developed to explain man-made physical systems such as the Internet, rather than a biological system like man himself (Johnson and Proctor 2004; Pierce 1980).

The influence of linguistics is somewhat different from that of the other non-psychological disciplines since it deals with the same phenomenon like some psychologists: human language. However, it is subject to discussion whether or to what extent linguistics and psychology are epistemologically distinct (Antony 2003). In spite of that, linguistics strictly maintained that behaviouristic psychology underrated the novelty, productivity, and complexity of human language use, and that its structured nature is thereby totally ignored. Consequently, actual speech behaviour was deemphasised and instead the underlying competence of applying specific rules in mind emphasised; in fact, almost each pre-theoretical idea of behaviourism was challenged (Davitt 2003; Laurence 2003).

The clash culminated in the influential review of Noam Chomsky (1959) on Skinner's book 'Verbal Learning' (1957). In this work, Skinner had attempted to turn a few simple principles of learning and reinforcement into a complete account of how people acquire and use language (Skinner 1957). Chomsky's review was actually an attack on all stimulus-response accounts of language. Particularly, Skinner's and general behaviourist's believe in explanation by extrapolation of simple principles identified in the laboratory was attacked. It was argued that while such an approach appears scientific, these conceptualisations were more carelessly mentalistic than those of the traditional (linguistic) approach (Lachmann et al. 1979). The dispute ended about ten years later with the emergence of a new field called psycholinguistics, which shares much with the information processing approach to cognitive psychology. Here, language is regarded as a product of the human mind as a rule-governed, abstract system that is investigated with the sentence as main unit of analysis (Field 2003).

The intimate relationship between computer science and contemporary cognitive psychology justifies the treatment of computer science's role, particularly since both are derived from seminal works in mathematics that occurred during the first half of the twentieth century. Further, both are centrally concerned with the nature of intelligent behaviour. The importance of computer science is still evident in the research stream of cognitive science, focussing on cognitive computing and artificial intelligence (Eysenck and Keane 2000). However, computer science itself cannot be considered a homogeneous field; it is rather a variety of loosely related subspecialties, such as algorithm theory, numerical methods, automata theory, programming languages, and artificial intelligence (Reilly 2004). Historically, in the 1960s researchers began to deal with intelligent behaviour beyond in terms of measurement; for instance, they suggested that humans use different strategies that can be conceptualised as plans (Miller et al. 1960). Already about 100 years ago, issues were raised in metamathematics concerning the related problems of computability and proof (Kleene 1952). In order to solve these problems, mathematical systems, conceived as symbol-manipulating systems, were developed that were able to perform any fully specified logical or mathematical procedure with only very few properties and capabilities (Voss 1995). In this context the main intention of researchers in relation to the psychology was to develop such mathematics-based computer systems that imitate or simulate human behaviour and the underlying cognitive processes (Wessells 1994).

Based on this notion, Newell and Simon were the first to express the critical insight that the mind might be considered as such a general symbol-manipulating system (Newell and Simon 1972). According to this view, some mental processes can be described in the precise, concrete, and objective terms of mathematical logic rather than by intangible abstractions (Lachmann et al. 1979). This metatheoretic view has met with general approval. But psychologists differ in the degree to which the formal concepts of general-purpose symbol-manipulating systems can be used as analogy to the human mind (see for a philosophical discussion Voss 1995 or chapter III.B.1). But notwithstanding that several aspects of the human mind, in particular creativity, cannot be kept with the formal-analytic approach, even those who work with a rather loose analogy between human information processors and computer programs note important similarities, like the generality of purpose, which means a computer can follow any instruction put in proper symbolic form (Lachmann et al. 1979).

Often strongly shaped by these direct intellectual antecedents, scientists base their work on certain conjectures and tacit beliefs about the nature of the reality under investigation, which could be called pretheoretical ideas or a general axiomatic. These have a significant impact on research and aid in the formulation of experimental questions (Rosenberg 2000). In this regard, it is not of importance whether these ideas are verified later on since they always serve as a kind of guide to the researcher, as conventional. Often, pre-theoretical ideas also influence the definition of the subject matter by suggesting what are (and what are not), instances of the phenomena he intends to study. The set of beliefs in the IPP, what might be called an ideology, rests on the view that human beings in certain cognitive tasks act like an information processing system (IPS) (Valsiner and Leung 1994).

This central conjecture in the IPP is an illuminating example for the observation that researchers, when beginning to pay attention to a phenomenon about which little is known, often tend to borrow principles from more advanced areas; these can guide their research and help to gain an overview of the ill-structured (new) domain (Bailer-Jones 2002). For example, consider the influence Darwin's evolutionary view had on a lot of other disciplines, such as philosophy of science or economics (see for an overview Oldroyd and Langham 1983). This dimension of analogies is closely related to pre-theoretical ideas but not necessarily the same. However, for the IPP, the computer analogy, quite palpable in the conception of the human mind as information processing system, is more than just a metaphor since the human properties that involve symbol manipulation can be regarded as instances of the same theoretical abstraction that is used as the conceptual prototype for computers (Parkin 2000).

Nevertheless, some psychologists view their theorising as analogical rather than instantiational. However, research and theory are mainly guided by the computer analogy since the function of the mind is comparable to some function of computer programs (Lachmann et al. 1979). Accordingly, research in the IPP, as outlined sharing a basic set of assumptions (Beilin 1983), could be distinguished according to its relation to the computer analogy: rather structural theories adhere to its principles (for example Newell and Simon 1972), while others are rather functional and merely influenced by this particular view. It should be apparent that the present work, accounting for the creative element of human subjective perception expressed by the principle of cognitive creation, ought to be counted to the latter kind,

However, based on its central assumptions, the IPP approaches its subject matter, a term which refers to the questions for which answers are desired; i.e. could be called the "starting point" for studying something (Pronko 1952). Generally, within a paradigm those questions are asked, which seem to promise the most complete account of the system under study; nevertheless, researchers attribute different importance to a certain aspect: In psychology for instance, the natural system as object of investigation is the behaviour of living creatures (Lachmann et al. 1979). As to human beings, the subject matter of psychology could be regarded as, "[…] man qua man, his powers, operations, nature." (Adler 1995, p. 82) However, some researchers believe that the most important aspect is their personality and prefer to study individual differences. Others might ignore individual differences and are interested in typical performance, for example those, who believe that learning is the most fundamental characteristic of livings. At the highest level of abstraction, the subject matter in the IPP of cognitive psychology is man's mental processes. Its basic mental capabilities are attention, perception, abstraction, problem-solving, learning, memory, and language. Nevertheless, there is little agreement in the scientific community as to which of these are the more basic processes and it has been concentrated in varying degrees on all of them (Lachmann et al. 1979).

Having assumed a perspective on a phenomenon, scientists agree on a terminology that is often to a certain extent - similar to analogies transferred - borrowed from other disciplines. Indeed, there is an intersection between the new terms for concepts and data peculiar to a paradigm and others. In particular computer science has contributed a variety of expressions to the terminology of information processing psychology (Lachmann et al. 1979). Anyway, typically there also exists a unique set of terms of a paradigm. Nevertheless, it might be objected that such differences are only semantic. Notwithstanding, some central terms ought to be introduced in the different context of the IPP and its main predecessor behaviourism since their meaning has changed significantly as to the underlying beliefs and basic properties (Lachmann et al. 1979).

In order to provide a brief overview, it seems to be most fruitful to name such terms, which are frequently used by other paradigms in psychology, but usually have a somewhat different meaning in the IPP: to begin with, stimulus and response - crucial terms in the behaviouristic paradigm - are here merely laboratory terms, defining laboratory operations. A stimulus is whatever is presented to a subject in an experiment, and its response is whatever is done that can be measured. In the IPP the terms of input and output are usually used for this purpose (see Parducci and Saris 1984). Another important term in behaviourism with another meaning is the ‘association’: The term had a restricted meaning in the sense that it was the init formed by conditioning, being an automatic process that requires contiguity between environmental events. In the IPP, ‘to associate’ means to know what objects or events have to do with one another and can occur totally within the mind of the thinker (Collins and Quillian 1972).

Finally turning direction to the conventional rules in a discipline, this term refers too researchers’ preferences for particular experimental designs or dependent variables, etc. (Proctor and Vu 2003). This point is of particular interest in the IPP since behaviourists have never really neglected the importance of mental operations, but rather doubted the methodological aspect of investigating it. Along these lines, researchers in the IPP are indebted to develop and implement research methods that allow for explanations of mental computing and mental states of the human mind. Such inferences to underlying mental processing mechanisms in the IPP are generally made by designing and executing multiple experiments and by using convergent validation techniques (that provide information on the correspondence on measures designed to investigate the same construct) (Lachmann et al.

1979). This technique is applied if the phenomenon under investigation cannot be directly observed and instead only observations can be made that place constraint on the possible workings of the mind.[xiii] In this case, interlocking inferences permit construction of valid, factual statements about the unobservable properties. In other words, data of several different kinds converge on a conclusion (see for instance the seminal work of Garner et al. 1956). Furthermore, various techniques are employed to decouple cognitive processes from their natural system in order to assess their unique function since in the IPP the human mind is considered to be a complex system, which parts work in concert.

However, the ambitious goal of cognitivism to overcome the ‘black box’ assumed by behaviourism has led to the application of sophisticated methodological devices within the IPP: For example, researcher distinguish separate segments of time between a stimulus and a response executing Sternberg’s additive factor method (Sternberg 1969) or Donder’s subtraction method backward masking, and mathematical models (Massaro and Cowan 1993). Nevertheless, others doubt this approach and conceptualise mental process more weakly as intervening variables. In this view, information processing is purely pragmatic in allowing descriptive and predescriptive accounts (Van der Heijden and Stebbins 1990). Consequently, according to their view, the only reasonable goal is to describe differences in an individual’s behaviour as a function of differences in external and/or internal conditions (Hatfield 1991).

Even though many differences exist between cognitive and behaviourist methods, the latter’s experimental paradigm has been kept to a high extent (see also Massaro and Cowan 1993). Intuitively, this could be attributed to the difficulty of directly observing such information processing in the human mind at work. However, contemporary researchers in the IPP typically use behavioural or psychophysiological methods, emphasising chronometric measures (Proctor and Vu 2003). In a different approach, the model of verbalisation of thoughts claims that subjects express their thoughts as these enter attention under a concurrent verbalisation instruction, often called ‘think aloud’. Such dense records of the subject’s solution process - called ‘verbal protocols’ - provide information to investigate the contents of information accessed from long-term memory, which would not correspond to perceptually available information (Ericsson and Simon 1984). Studies have shown that there is a good correspondence between sequences of intermediates steps identified by the task analysis and steps inferred from verbal reports and eye fixations there is a good correspondence (Ericsson and Hastie 1994).

This should have made clear that within such a paradigm different streams have formed taking different assumptions or having different emphasis of their study. However, most contemporary empirical research on thinking tasks stands out that disagreements between models and theories only consist in competing claims about the sub-stage structure of the modal strategies, as well as about details of processing within stages or states, while the basic conjectures are almost universally accepted (Ericsson and Hastie 1994). Seizing this, two major streams can be identified: Firstly, the Newell and Simon School in which simulation of a wide range of mental activities by complex information processing models is emphasised (Massaro and Cowan 1993). Other researchers instead highlight "[…] fundamental operations that can be used to characterise the human mind." (Posner and McLeod 1982, p. 478)

In some more detail, Massaro and Cowan (1993) identify four main variations of the information processing framework: (1) Physical Symbol Systems (PSS), (2) Connectionism, (3) Modularity, and (4) Ecological Realism. The approach of physical symbol system refers to the already mentioned Newell and Simon School that focuses on symbolic architectures, in its fundaments relatively strong tied to computer sciences (see e.g. Newell and Simon 1972; Newell et al. 1989). Generally, the assumptions of the PSS framework are more restrictive than those of the general information processing approach, presented above. In particular, only arbitrary physical tokens are manipulated by explicit rules that are, themselves, composed of tokens. These manipulation-processes are exclusively based on the physical properties of the tokens, independently from their meaning (see also Hoffmann 1998). The variation of connectionism could be described by the features it includes. Within the approach it is assumed that a set of processing units is interconnected by connection weights. If input is given into the system, this causes activations that are modulated by these connection weights. Input to each unit is guided by an activation rule, adding the input to the current state, finally leading to an output. The system of processing units and connection weights itself underlies a dynamic process: learning rules in form of mathematical functions manipulate the connection weights, thus also altering the input and output processes (Bechtel 1991; Rumelhart and McClelland 1987).

Another framework that has been offered - called modularity framework - assumes independent input systems, e.g. a system responsible for object perception, and more general cognitive processes that are called central systems. Each input system uses different information and processes, an aspect that could be regarded as domain-specificity. The most notable peculiarity of these input systems is their so called encapsulation: Processing is exclusively influenced by information within the input module's domain. For instance, this conjecture suggests that the speech module of the information processing system is solely shaped by speed input, and not by situational or linguistic context (Massaro and Cowan 1993). Finally, ecological realism is best described in terms of what it rejects (Gibson 1979): It denies the notion that perception is a form of knowing because the idea of an ambiguous environment embellished by processes of the perceiver is rejected. Instead, the perceiver simply extracts invariants from the sensory flux. Nevertheless, processing occurs by picking up these invariant relations of the environment, thus excluding intermediating processes (Carello et al. 1984).

Notwithstanding that many research streams have emerged and many arguments are quite convincing, cognitive psychology and the IPP still suffer from chronic problems that first and foremost philosophers object; besides the already touched issue of accounting for singularity and subjectivity, two main objections should be mentioned: The qualia-argument and the intentionality-argument. The former targets on the insufficient account of cognitive approaches of the feel or the phenomenal character of a mental stated. The latter rather argues against the disregard of propositional attitudes, such as intentions or wishes. It is criticised that such attitudes represent an actual or possible state of affaires, but cannot be explained by a hypothetic state of the IPS (Lycan 1999). In this regard the Brentano-question became quite well known, asking how any purely physical entity stated in an IPS could have the property of being about a nonexistent state of affairs or object; it is argued that physical objects cannot have this property (Lycan 1999). Concluding, resulting from the paradigm's characteristics sketched here, several fundamental terms of the IPP can be defined in order to provide a clear-cut framework and terminology used in the present work; this section is aimed at providing such definitions and further basic assumptions, necessary to understand the view of information processing in cognitive psychology assumed here.

Starting with the central concept of information, the etymological provenience of the word can be found, according to the Oxford Dictionary of English (2004), in Latin; by adding the common 'noun of action' ending '-action' (descended through French from Latin "-tio") to the earlier verb 'to inform'. It was then used in the sense 'to give form to the mind, to discipline, instruct, or teach'. The verb 'inform' itself stems from the Latin verb 'informare' (coming to English via French), 'to give form to, to form an idea of'. However, Latin itself already contained the word 'informatio' meaning 'concept' or 'idea', but the extent to which this may have influenced the development of the word information in English is rather unclear. It should be noted that the notion of information in the IPP and in the present work - in accordance with the metaphysical stance alleged - is not identical to the classical information measure that is seen as the amount of information in a given message, positively correlated with how much the message reduces the number of possible outcomes (Shannon 1948). Formally, this definition resembles the mathematical definition of entropy (Tribus and McIrvine 1964) and embraces many difficulties in understanding human communication (Blaseio 1986).

Disregarding the formal difficulties to unambiguously define such information, in practice a precise definition is not crucial since in the present work it is dealt with types or categories of information, such as feature values, or category assignments that distinguish among potential stimuli or responses in a specific experimental situation (Neisser 1967). Instead, for IP models like the present it is far more important to distinguish between data or stimuli and information: Data or stimuli lie outside in the external environment, and information is located within the human receiver, influenced by many factors, in particular knowledge (Massaro and Cowan 1993).[xiv] Accordingly, in the present work the term information "[…] refers to representations derived by a person from environmental stimulation or from processing that influences selections among alternative choices for belief or action." (Massaro and Cowan 1993, p. 384)

Once again, the reader should pay attention to the constructivist and subjective conception of information in the present context: information is idiosyncrately built by human beings and cannot be described without referring to a particular situation and a particular human being at hand (Weizsäcker 1971). Once again, this contemporary notion of information from cognitive psychology strengthens the argument that the traditional view of incomplete or complete information is not useful and - in this terminology - simply makes no sense at all. Further to this, such a view on information provides another clue for a realistic view on creativity and novelty: information always involves both novelty and confirmation (Weizsäcker 1974). The idea behind this is that information only makes sense, respectively is pragmatic or useful for a human, if it has any relation to pre-existing information, thereby somehow confirming something. This excludes pure novelty since such information would have no value for the individual at hand. At the same time, pragmatic or useful information must also include novelty since pure confirmation adds no value to an individual.[xv] If information in the present understanding always involves novelty and conformation, structure and evolution, it becomes clear that pure creativity unbound to any given structure (creatio ex nihilo) is simply impossible.

Talking about information, it is a general truism that information and knowledge are not identical; and even though chapters III.B.2 and III.B.3 are exclusively dedicated to human knowledge and its representation in the human mind, it should be mentioned at this point that "[…] information can be considered as a flow of messages or meanings which might add to, restructure or modify knowledge. Information is thus a necessary and inseparable medium for establishing and formalising knowledge." (Muller 2001, p. 38) This refers to the central conjecture that, independent of the way knowledge is seen or modelled, it is a crucial aspect of approaches in the IPP to involve and explicate the background knowledge and relevant information considered by subjects in thinking processes. Therefore, an extremely important conclusion is that relevant knowledge in a domain is of particular importance (Simon and Chase 1973).

Similarly to knowledge, it should be provisionally defined that in the IPP the second central cognitive element of mental computation, which is usually considered as thinking, is describable as a sequence of identifiable knowledge states or thoughts separated by some processing activity, determining the transition from one state to the next. Each state is describable by a limited number of activated working memory structures and thoughts that represent the primary input to the process or processes that produce the next state (Ericsson and Hastie 1994). Merging this with the notion of information alleged above, it is not a big step to come to a provisional definition of the mental computing or processing of such: "Information processing refers to how the information is modified so that it eventually has its observed influence." (Massaro and Cowan 1993, p. 384) Thus, the basic notion is that one must trace the progression of information through the system at hand from stimuli to response.

More detailed, Palmer and Kimchi (1986) identify five properties or principles of the information processing approach to thinking: The first principle that environment or external world and mental processing can be described in terms of the amount and types of information (informational description). Secondly, the concept of recursive decomposition (or hierarchical proposition) denotes the breaking of one stage into sub-stages. Further, the flow continuity principle states that information is transmitted forward in time and that all inputs necessary to complete one operation are available from the outputs that flow into it (Ericsson 2003). Resulting from this, the flow dynamics principle implies that each stage or operation consumes some time. Finally, the physical embodiment principle embraces the assumption that information processing occurs in a physical system - neurophysical in the human brain - and information is embedded in states of the system called representation and operations used to transform the representations are called processes.

All these concepts presuppose that the human cognitive system can be best understood as information processing system since it operates a variety of processes (see e.g. Newell and Simon 1972; Styles 2005). Such an approach is by nature a nonphysiological theory, ignoring underlying mechanisms like electrical, chemical, or hormonal processes. Practically, a lot of important physiological processes cannot be observed and analysed appropriately to model complex human thinking tasks in an adequate way (Newell and Simon 1972). At the same time, such a theory is quite technical and precise, offering an array of advantages for modelling symbol manipulation by human cognitive processes (Dawson 1998). Nevertheless, coming along with new technological possibilities to make the unobservable action in the ‘black box’ observable, physiological aspects become more and more an focus in the field of psychology, and therefore also within the IPP (Johnson and Proctor 2004).

Whatever phenomenon is modelled within the paradigm, the concepts all share some common characteristics. This is obviously of interest in the context of the present work since a model of creative thinking is applied to economic settings in chapter IV. An axiomatic conjecture that models share is that information processing is assumed to occur efficiently. Such a cognitive efficiency in information processing cannot be defined unambiguously for all instances since the notion depends on the goal involved in the cognitive effort. However, with respect to absolute goals - the most important and most applied goal structure, particularly in problem-solving - cognitive efficiency simply means to achieve them with the smallest possible expenditure of whatever resource (time, processing capacity, etc.) (Sperber and Wilson 1995). Further, IP models are similar in that they “[...] are theoretical descriptions of a sequence of steps or stages through which the processing is accomplished.” (Massaro and Cowan 1993, p. 384) Therefore, the construction of an IP theory means, in a first instance, to postulate the stages of processing.

Generally, such attempts start with mapping out a logically necessary sequence of processes that must, at least, include stimulus decoding and response selection stages. Although an IP model usually describes the mapping from one stage to another, it is mostly the case that several different stages can operate at once (Massaro and Cowan 1993). However, in support of this conjecture different studies were able to gather evidence that information processing occurs in stages. For instance, Sanders (1990) identified seven strategies of processing, Massaro (1991) investigated perception-action relationships in a similar model, or Roberts (1987) provided evidence by food deprivation and reinforcement tests with animals (rats, pigeons, and goldfish) that can be best explained by assuming stages of information processing. As to humans, Theios and Amrhein (1989) did research on reading words and naming pictures underpinning these results. Since this is very important to the present work, subsequently, it will be briefly introduced, which general assumptions any information processing model has to make for characterising its stages of processing.

Generally speaking, if any kind of stimulus is given, it can be distinguished between (1) input and output representations; as well as (2) transformation and transmission processes. Furthermore, each of these representations and processes can be characterised as (3) discrete or continuous (Miller 1988, 1990). In more realistic settings, multiple stimuli are at hand, which means that such models must allow multiple codes or information to co-exist in one stage, which either (4) can be processed in parallel or serially. Furthermore, (5) strategic and attentional effects can under certain circumstances modulate the character of information processing. It has already been indicated that each representation developed, transformation accomplished at a particular stage, and information transmitted to the next steps of processing either occurs in discrete steps or continuously.

This differentiation of information processing models along the dimension of whether representation, transformation, and transmission are discrete or continuous was introduced by Miller (1988, 1990) (see for a brief overview Proctor and Vu 2003). This classification is of particular interest to psychological examinations that are based on subjects' reaction times. Apparently, in such experiments it makes a huge difference how processes are actually executed by the information processing system under investigation. Researchers in the field are still debating whether models of discrete or continuous representations and processing are more accurate in explaining their results (see for an overview Massaro and Cowan 1993). As result, researchers came up with different types of models: discrete models, in which all the representations and processes are regarded to be of a (1) discrete nature; (2) asynchronous discrete models that are an intermediate between discrete and continuous models based on the assumption that successive stages can overlap in time, i.e. information can be transmitted to the next stage before the current stage is complete. However, the transmission of information about each separable code within the stimulus is discrete (Miller 1988). Finally, (3) continuous models predict that information along a single dimension is transformed and transmitted continuously (Proctor and Vu 2003). The present work assumes discrete steps of processing and representation; therefore, it is more crucial to emphasise that in any case the idea of sequential stages in information processes is meaningful. The rather 'technical' research on the basics of information processing models does not contribute to the attainment of the present work's objectives.

While the distinction between discrete and continuous processing is built on focussing on the processing of a single stimulus, the issue of serial vs. parallel processing concerns the transmission or transformation of an array of stimuli at each stage. The major question in this regard is to find out whether a human executes a process serially, parallel, or probably even both simultaneously since the form of processing must be settled independently for each processing stage of the modes (Lachmann et al. 1979)? This aspect is even more important to more general (or realistic) models of human thought since, generally, IPS must deal with an entire stimulus field (Massaro and Cowan 1993). The terms - derived from communications engineering and information theory - are quite self-explanatory: Serial processing means that a stage can only handle one item at a time, while parallel processing refers to the handling of multiple items at the same time (Parkin 2000). Some authors argue that this traditional distinction of serial vs. parallel processing may not be ideal for capturing what is most important in this concern. Instead, a more detailed analysis would differentiate fully serial processing, several degrees of capacity-limited parallel processing in which multiple items can be processed at once, but only with some interference in-between take place, and, finally, capacity-unlimited parallel processing without any interference; thus, putting it on a continuum (Duncan and Humphrey 1989). The point is that this is not only a descriptive or formal question, but rather has implications on the processing of a system with a given number of stimuli, thereby significantly determining the processing's efficiency.[xvi] The present work, in particular important to the process of information encoding, assumes that information is mainly processed serially.

A related issued often addressed in literature on cognitive psychology is the differentiation between conscious and unconscious processing of information: But it is not subject to discussion whether unconscious processes of the human mind matter in creative problem-solving, but rather how and to what extent this holds true (see generally Arieti 1976; Dudek and Verreault 1989; Kris 1952; Suler 1980). It seems that unconscious, unarticulated processes have a rather indirect, supporting influence, which should nevertheless not be underestimated. For example, they might provide new kinds of category combination and reorganisation or bring new kinds of relationships among categories into the conscious mind of creative thinking (Mumford and Gustafson 1988). It could also been hypothesised that ongoing unconscious process operation lead to such insights (Mumford et al. 1991); thus, resembling to the notion of illumination in classical models (see chapter III.C.1). As already argued by assuming that cognitive capacity is limited, attention is important and has generally to do with limitations; in the IPP, these are seen as processing bottlenecks (see e.g. Duncan 1980; Sorkin et al. 1973; Pashler 1989; Pashler 1990). Pashler (1990) distinguishes three of such bottlenecks in distinct stages of processing: (1) perceptual encoding of the stimulus, (2) response buffering in memory, and (3) response selection. Considering the relationship between attention and perception, it must be kept in mind that perception is highly influenced by attention. If, in an IP model, the stage called perception is decomposed into two sub-stages - e.g. featural encoding and featural combination - these are influenced by attentional aspects to a different extent. However, perception is also partially preattentive, which means cues are recognised by the individual but not attended to (Massaro and Cowan 1993). However, the present work will not deal explicitly with the difference between conscious and unconscious aspects of thinking since it will become evident that, assumingly, humans do not have any direct and conscious influence on their cognitive preferences anyway.

Although probably quite evident, most research on thinking shares another methodological characteristic: The dominant research traditions in cognitive science have been at least implicitly individualistic (Wilson 2004). The term of "[I]ndividualism in psychology is the claim that psychological states are taxonomized without essential reference to the environment of the subject possessing them; in other words, they supervene on the subject's intrinsic, physically specifiable, states." (Egan 1994, p. 258) The main cognitive elements of representation and computation exhibit characteristics that induce scientists to select such a methodology. Doing so, cognitive sciences assume that the mind interacts with the world perceptually and behaviourally through internal mental representations of the external world. This implies that environmental influences are peripheral in the sense that they can only matter to cognition by altering the internal mental representations (Jackendoff 2001), an argument similarly alleged by Chomsky for the study of language (Chomsky 2000).[xvii]

However, other psychologists and philosophers of science argue for the extreme social and physical importance of the external environment for human behaviour, thus, criticising the methodological individualism explicitly or implicitly inherent in many contemporary computational theories of the mind (McClamrock 1991, 1995). A variety of scholars emphasises the importance of such an embedded view on psychological phenomena, often called situated cognition (Kirshner and Whitson 1997). Situated cognition theory has emerged from anthropology, sociology, and cognitive science and represents a major shift from traditional psychological views of learning as rather individualistic and mechanistic, and moves towards perspectives of learning as social and emergent (Brill 2001). The development of situated cognition or situated learning is often attributed to Brown et al. (1989). It is argued that essentially embedded states cannot and should not be fruitfully examined in isolation from their embedding context, i.e. that real-world problems impose constraints and restrictions, reason why they have to be taken into account (McClamrock 1991). However, it should not been forgotten that the human mind is here modelled to be able to proactively think with an intentionality. For the purpose of introducing a model of thinking processes involved in opportunity recognition the following paragraph introduces a basic way to depict cognitive processes in a more formal manner, based on the previous considerations concerning information processing models, providing a notation for the upcoming model of opportunity recognition.

For all efforts to compute human thinking, usually denominated as artificial intelligence, it is aimed at finding a formal way to represent states and processes of the IPS. On a basic level - which should be sufficient for the purposes of the present work - the two basic cognitive elements of knowledge structures and information processes are represented in a form that can be computed (Sowa 2000). Since memory and the representation of knowledge stored is treated in more detail in chapter III.B2, the concrete and more formalised representation of knowledge structures in the present work is introduced following these considerations. However, at this stage it appears useful finding a way to model information processes in general and depict them graphically. For formalising procedures, processes, or even histories most often state-transition diagrams such as flow charts, finite-state machines, or Petri nets are used (Sowa 2000). All these graphical notations share the same basic principles; therefore, by merging the ideas of flow charts, originally designed by artificial intelligence pioneers Goldstine and von Neumann (1947) as well as finite-state machines, Petri nets offer a general and flexible base to represent any cause and effect, and in particular human information processing.

Designed by Carl Adam Petri (1962) they represent states as circles, which are called places, and computational events as events that are called transitions. While each transition stands for a possible event, the input states of this transition represent its causes, and the output states represent the effects. Further, conditions can be defined which are true and false, thereby determining which of two alternate paths are taken.

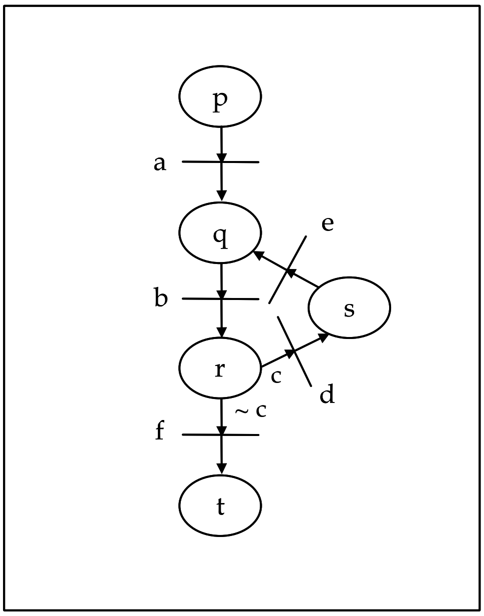

Figure 12 Example of A Petri Net (Sowa 2000).

For example, consider the Petri net in Figure 12. The states are labelled *p, q, r, s*, and *t*; the events are labelled *a, b, d, e,* and *f*. In this example, state *p* is the precondition of the event, *a* and state *q* is its post-condition. In state *r* two possible paths can be gone: if condition *c* is true than follows event *f*, if it is false follows event *d*. On a basic level, applying this notation to the general model of human action in time could be depicted as shown Figure 13.

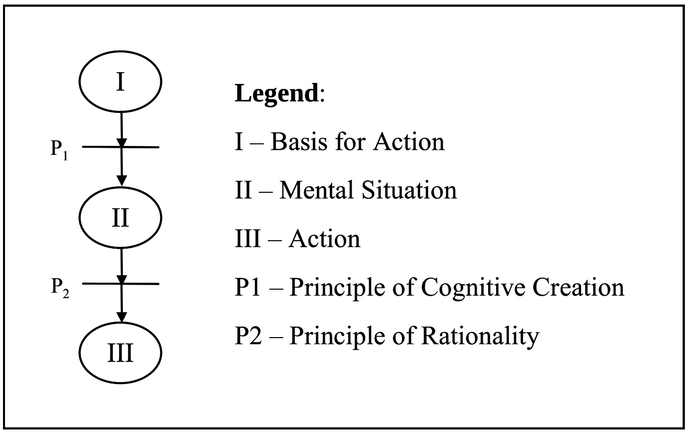

Figure 13 Human Action Time as Petri Net.

This Petri net includes the three major states of the model, say the basis for action *I*, the mental situation in the human mind *II* and the action chosen *III*; while the basis for action is transformed into the mental situation by the principle of cognitive creation P_1, this mental situation is transformed into an action guided by an event that is, in turn, guided by the principle of rationality P_2. As already said, the concept of creative thinking that will be developed subsequently models the information processes involved in coming to novel, creative mental situations based on a given situation; this whole process is here only depicted on an aggregate level. However, it will be shown later that such information processes can be conceptualised on different levels of elaborateness. What will be modelled and depicted in chapter IV.C can, therefore, be seen as the result of a zoom in, focussing on the principle of creative cognition.

Having introduced the way human thinking is modelled in the present work, still nothing has been said about the conceptualization of the human mind. Therefore, the human mind will be outlined now as an information processing system that operates the cognitive processes outlined above. Further, it will be shown how knowledge can is stored in human memory. Particular emphasis is put on the predominant way of devising conceptual knowledge structures: as mental models and schemas.

B. The Human Mind

1. Information Processing Systems

As indicated, in contemporary cognitive psychology the human being is thought of as an active processor of information, which may arrive as sense data or is generated externally from stored knowledge (Styles 2005). None of these two concepts - information and processing - had been new, but rather the image that a digital computer can model man and his thinking processes was original about this idea (Newell and Simon 1972). The main change induced by the computer metaphor in cognitive psychology was to distinguish several components of the human mind: A component that analyses the input, one that stores information, another which executes particular subroutines depending on the input, and so forth (Styles 2005). This conception is based on the conviction that, even if computers and humans differ in their physical constitution, they both manipulate symbols and can carry out a particular action through the pursuit of logically similar steps and procedures.

Based on this, during the last years and decades the two disciplines, cognitive psychology and computer science, were able to mutually enrich research on a variety of topics. For instance, psychological theories about schemes and propositional representation haven enormously benefited from research in the computer science. Cognitive psychologists have attempted to design such computer simulations of the human mind for several reasons: Firstly, a theory that can be implemented and simulated on the computer can be measured through the correct problem solution at disposition. Secondly, psychologists are interested in define the terms of comprehension and representation as explicit as possible, because only explicit theories are testable. The third and probably most important reason consists in the advantage of such a genuinely psychological theory, which contributes to research and generates useful concepts (Wessells 1994). Nevertheless, it remains a metaphor with limitations: The human brain is animate, compared to inanimate computers, and humans can move around in the environment, and, vice versa, the environment can act upon persons. Furthermore, external stimuli are not only responded to but can also be modified (Styles 2005).

However, in chapter III.A.3 it has already been mentioned that Broadbent (1958) is often named as the first one, who applied the notion of information processing system. Although the model he presented is frequently described as a model of attention, it also includes perception and memory. Thus, it can serve as a simple example of a general model of human information processing and, thereby, of the human mind as an information processing system. His model, shown in Figure 14, depicts human information processing in a flow chart, which is a sequence of interconnected boxes and arrows. Each box on the chart represents a component process or stage of the overall tasks, which must be completed before the next stage can be arrived (Styles 2005).

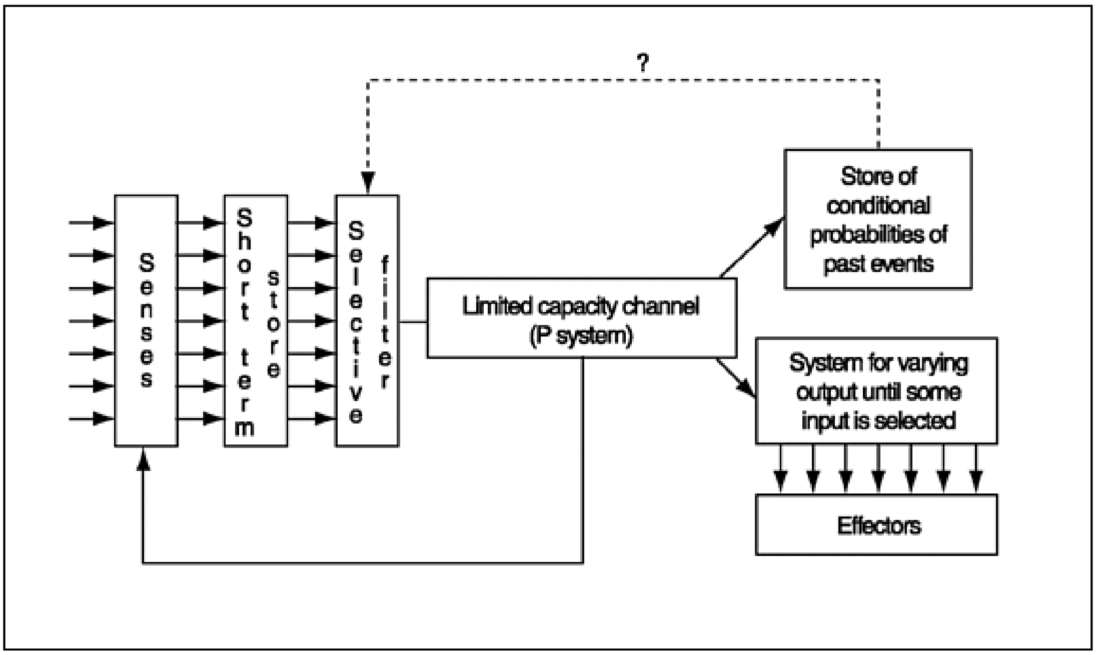

Figure 14 Broadbent's Model of The Human Mind (Broadbent 1970).

The model is presented to provide a first impression of how the human mind could be conceived as an information processing system. It provides a sketchy idea of the processes that are executed by an IPS from the senses that select input for short-term memory store, which, in turn, filters information for the limited capacity channel that serves as link to long-term stores or effectors. Apparently, the model is limited in its capability to show the complex and various interactions of the central human cognitive processes of attention, perception, and memory. Therefore, these are dealt with in some more detail hereafter.

However, some conjectures have to be made before as to the human mind as an information processing system that are already adumbrated in Broadbent's model: Firstly, the human mind's information processing capacity is limited. Secondly, human beings seek to minimise cognitive efforts, reason why it is assumed that they often use various techniques (for instance heuristics) to achieve this. These two assumptions, amongst other reasons, imply that thinking is often less than totally rational characterised by cognitive biases and errors (Baron 1998). It is the psychological argumentation for a realistic view of human agency in economics, embracing such cognitive phenomena as inherently human and not as imperfection that can be removed theoretically (see chapter II.A.2).

Before introducing store models of the human mind that explain the storage of information and corresponding processes, central terms are briefly outlined that belong to almost anyone's vocabulary but are often attached different meanings to: attention and perception. Basically, perception determines how stimuli of the external world are transformed to information, the unit on which an IPS is assumed to work on. In turn, attention refers to the processes that select that information that are processed, accounting for limited processing capacity that impeded to process all information available. However, it should be noted that in more realistic terms attention, perception, and memory cannot be seen independently since they all highly determine each other. However, they can and will be presented as different cognitive activities. The following considerations shall rather briefly characterise them, so that in the present work, it can be unambiguously referred to the terms and the human mind as an information processing system (IPS).

Beginning with attention, it can be said that many varieties exist, but in the most general terms it refers to the selection of a subset of information from the total set of information available for further processing by another part of the IPS since processing capacities are assumed to be limited (Stafford and Webb 2005; Styles 2005).[xviii] A very important function of attention in the context of the present work is the selection from a subset of sensory input or sense data probably required for perceptual processing. This can be called ‘attention for perception’ and its necessity in many situations is underpinned by search experiments (Goldstein 2002). Another one would be the attention for action; this is the selection of one or another form of response (Johnson et al. 2004). Both functions show that the cognitive functions are indeed highly intertwined (Styles 2005). Focussing again on the input side of the IPS, attentional selection is considered necessary because the rest of the processing system, as defined above, cannot process all stimulus inputs (or on the other side all response outputs) simultaneously. Thus, attention could be conceded the role of an active agent that selects (Cavanagh 2004).

An alternative explanation or modelling consists in describing it as a pool, or pools, of processing resources that can be allocated to perform cognitive tasks (Styles 1997). However, attention should not be only seen as an active agent selecting information for processing elsewhere in the system, this would be an underestimation of its impact on the whole system, because it also does processing on its own (Johnson and Proctor 2004). Yet another view does not deem attention as a cause but as an effect of processing. This approach is related to the subjective experience of what is being attended as the focus of conscious experience (see for the philosophical term Metzinger 1995). Then, attention can be conceived as the outcome of processing that allows an individual to know what it is doing (Styles 2005). The mentioned relation between attention and conscious experience leads to the distinction between processes that do or do not require attention. Most of processing in the human mind is not available to conscious inspection since it is unconscious and proceeds automatically, without necessarily the involvement of any attentional processes. Taking account of this, two distinct kinds of processes can be identified: (1) controlled processes, in which attention is involved in any form; and (2) automatic processes, without any form of attention involved (Styles 2005). This supports the distinction that has been introduced between reflexes and reflected action in the central model of human action in time from a psychological perspective.

In turn, perception means basically sensory processing since the sense organs convert physical energy from the external world, which is encoded and subsequently delivered to the brain via sensory neurons for interpretations by the perceptual system. This is summarised in an often cited general definition of perception: “The term perception refers to the means by which information acquired via the sense organs is transformed into experience of objects, events, sounds, tastes, etc.” (Roth 1986, p. 81) In the perceptual system different forms exist, for instance auditory or visual perception (Eysenck and Keane 2000; Styles 2005). Returning to the information processing paradigm, it can be stated that most early stages of perceptional processing are automatic and unconscious. Referring to more conscious processes, a more specific definition of perception would include an individual's phenomenal experience of seeing, hearing, touching, etc., i.e. its senses. Consequently, the final output of perceptual processing is a perceptual experience, such as seeing a face or hearing a voice instead of perceiving a fragmented pattern of light or auditory waves (Eysenck and Keane 2000; Styles 2005). In other words, "[…] the term of perception refers to the complex process through which we attempt to make sense out of the world around us by interpreting and integrating information brought to us by our sense with information and knowledge already store in cognitive systems." (Baron 2004, p. 56)

An example for an information processing approach to this is the fuzzy-logical model of perception (FLMP). Several studies support this three-stage approach tested in different contexts, for instance pattern recognition (Massaro and Friedman 1990; Massaro 1998), perception of facial effects (Ellison and Massaro 1997), and visual and auditory speech (Massaro 1998). The three stages of the process are depicted in Figure 15.

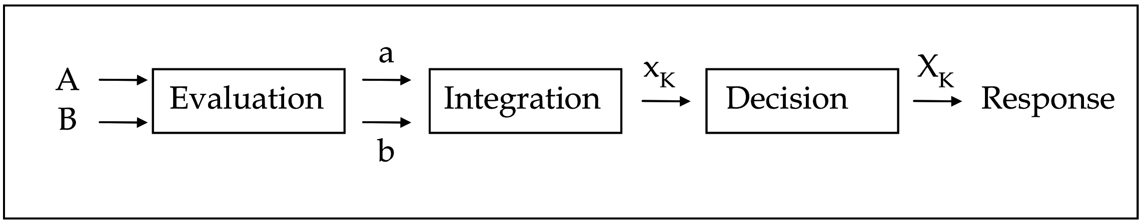

Figure 15 FLMP - Fuzzy-Logical Model of Perception (Phillipson 2002).

The first stage involves the decoding and evaluating of the relative sizes of the stimuli's salient features, and the production of so called fuzzy-truth-values (FTV), which are a kind of currency of the FLMP (Phillipson 2002). The magnitudes of the FTV are not changed in the subsequent changes, thus determined exclusively in the evaluation stage. In Figure 15, stimulus *A* and *B*, the salient features in the external world, are converted into the FTVs *a* and *b*. From an information processing perspective, this conversion can be modelled by mathematical functions, e.g. an exponential decay function (Nosofsky 1986; Shepard 1987). Each FTV is aimed at expressing the external feature's physical nature and a prototype's scaling parameter, thus comparing it to stored knowledge. In the second stage the two FTVs are combined, using a multiplicative rule in order to produce a single value x_K, which indicates the degree of support for a given alternative. In other words, it expresses to which extent it resembles to a stored prototype of an external object (e.g. a house). This value x_K is then passed to the decision stage where the single value is mapped onto a response alternative X_K (see for the model also Ellison and Massaro 1997; Massaro and Friedman 1990).

Once again, perception and attention can and should be seen as closely intertwined: Although the perceptual systems encode the environment around an individual, attention may be necessary for binding together an object's individual perceptional properties, for instance another person's face and voice. Additionally, attention might be of significance in perceptual processes since it selects the aspects, cues or data in terms of information processing on which perceptual processes act. If an individual can identify the information that represents the objects formed from perceptual data by attentional processing, this internal representation has contacted stored knowledge in the memory system. Indeed, studies in cognitive neuroscience on amnesia patients have shown that unless a stimulus is consciously perceived and attended to, it does not enter memory that can be explicitly retrieved. In turn, this does not imply that unattended stimuli do not unconsciously affect subsequent processing (Baddeley and Warrington 1970; Milner et al. 1968; Scoville and Milner 1957). This consideration leads us to another extremely important part of an IPS, the memory system (Eysenck and Keane 2000; Styles 2005).

A simple definition of memory says that it is a store of information and it is a result of learning (Styles 2005). In the particular view of the IPP, memory could be seen as "[…] systems, representations, and processes in living organisms that are involved in the retention of information." (Samuel 1999, p. 1) Anyway, psychologists have been capable to distinguish many varieties of memory, with different capacities. In this context, the term of capacity refers to the period of time information is stored and to different kinds of knowledge stored using different representations. Besides these two aspects, the storage also differs as to the way of recalling: Some memories can be recalled into consciousness, while others store knowledge that can only be demonstrated by the performance of actions. In addition to this static view on storage components, memory also involves processes or operations. The two most important are the encoding of information for memory and retrieving information from memory as and when required (Styles 2005). In the following it will be introduced a structural theory of memory and how information is assumed to be processed within this system.

2. Human Memory

While studying the next considerations concerning multi-store models of human memory it is important to note the difference between memory and stores, in which memory is 'deposited' (Styles 2005).[xix] For that, it will be gone back to the influential model of human memory introduced by Atkinson and Shiffrin (1968) that distinguishes between a sensory register, also called buffer, short-term memory, and long-term memory (Engelkamp 1991; Styles 2005), and is depicted in Figure 16.

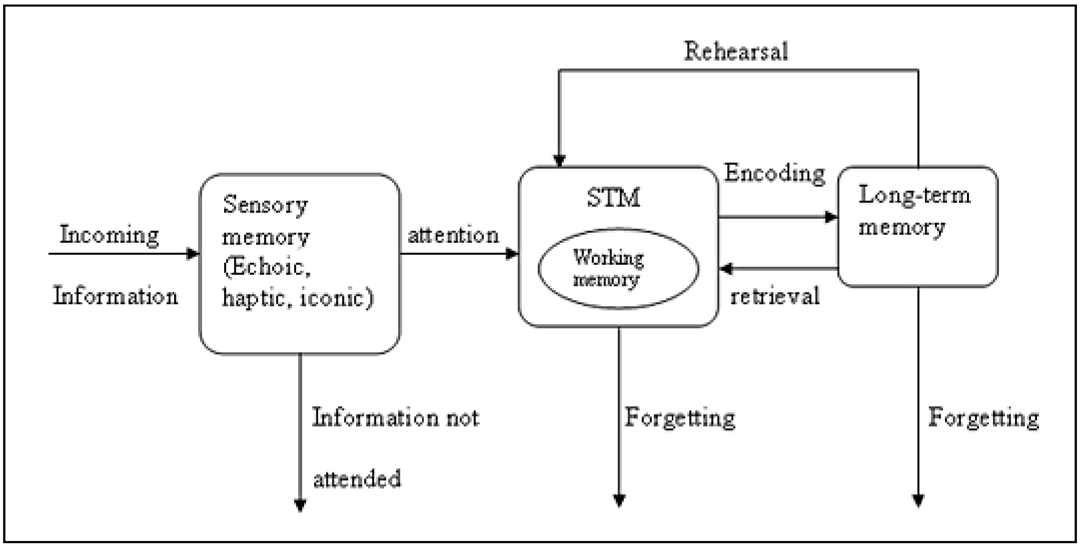

Figure 16 Human Memory (Atkinson and Shiffrin 1968).

Hereafter, it will be briefly presented how the components of the human mind differ and how the processes within the system are assumed to be directed by an executive control system that moves information between the stores; it is responsible for maintaining order in memory and for planning and decision making (Baddeley 1986, 1997; Norman and Shallice 1986).

At first, all information enters the buffer or sensory store of memory. Here, brief duration sensory memories are stored that have high capacity and fast decay. The name derives from its function as a buffer from which information selected by attentional processes can be encoded into more durable forms (Seel 2000; Styles 2005). Broadbent (1958) proposed that memory for periods of more than a few seconds is handled by a combination of limited capacity system and buffer memory store, which held information for a very short period of time only. Information fed through to the limited capacity system could be fed back into the buffer and recycled indefinitely; this process is called rehearsal of information. Thus, rehearsal is responsible for transferring items from a very limited capacity system to a more durable store. In turn, if rehearsal is prevented, items are rapidly forgotten (Brown 1958;

Waugh and Norman 1965). However, starting with the typical situation that a stimulus first steps in the system, it enters its appropriate sensory register. Buffer and limited capacity system are important to the whole memory system since human senses are ceaselessly exposed to information inflow that cannot be all paid any attention to. Irrespective of the sense modality, information is shortly retained here after the end of the stimulation, in case attentional processes decide it is worth extracting it as a key aspect of further analysis (Eysenck 2004).

In such a case, information is transferred to short-term or working memory, which stores information arriving from perceptual processing on the one hand (as in our example) and retrieves long-term memory stored on the other, while an individual is performing a task, for instance in solving a problem. In other words, short-term memory contains what we are currently thinking about (Styles 2005). The processing capacity is limited and remains conscious as long as it is attended to (Baron 1998); information still decays, but not as fast as in the sensory register since short term-memory is influenced by subject-controlled processes.[xx] The first to describe this limited capacity of short term memory was Broadbent (1958) in his Limited Capacity Filter Theory of Information Processing. Consequently, the main function of short-term memory could be seen in making information temporarily available, in order to create more endurable memory contents (Seel 2000). This, process of putting a stimulus from its sensory register (e.g. the visual sensory register) into short-term store is called information encoding (see chapter IV.C.2).

Eventually, information is then put forward into the store that can host the most durable memory: long-term memory. In fact, it is assumed that the remainder of an individual's knowledge - what is not located in sensory register or short-term memory - is stored in here. Theoretically, an individual can store unlimited knowledge in its long-term memory (Attkinson and Shiffrin 1968) and holds information from all the sensory modalities (visual, auditive, etc.). Independent of the validity of this statement, nobody would question that this store has to deal with an enormous amount of knowledge. Thus, it seems to make sense to look for more fine-grained conceptualisations of long-term memory, distinguishing between different parts. However, these parts of long-term memory are often assumed to be of a rather passive nature since they must be activated by short-term memory. However, this should not suggest a stable nature of long-term memory that it is not constant at all and rather subject to continuous changes of its contents (Seel 2000).

For instance, Tulving (1972) introduced the terms of semantic and episodic memory; the former term is referring to facts or general abstract knowledge, i.e., an individual's knowledge about the world. The latter embraces factual information acquired at a particular point in time, i.e., personal experience (Baron 2004). Another distinction introduced in the 1980s (Seel 2000), based on the differentiation between 'knowing that' und 'knowing how' (Ryle 1969), would classify both as belonging to declarative knowledge, which is memory an individual is able to tell someone else about its content. In other words, declarative knowledge categories are about objects and object properties in some domain. In turn, procedural knowledge is such memory that specifies how to do something, the principles for applying or acquiring declarative information. It is impossible to clearly explain them to other persons by words; they have to be demonstrated (Anderson 1990; Mumford et al. 1991; Seel 2000; Styles 2005).[xxi] Therefore, declarative knowledge is accessible consciously, while this is mostly impossible for procedural knowledge (Eysenck 2004). However, both are created from past experience and systematically related to each other in associative networks (Langley and Jones 1988). Yet another distinction, actually resembling to that between declarative and procedural memory, can be made between implicit and explicit memory. They are quite similar since, again, an individual can learn and demonstrate knowledge implicitly, that is without knowing they have the knowledge (Eysenck and Keane 2000).

The interplay between short-term memory and long-term memory can be modelled in some more detail: The former is responsible for transmitting information to the latter; additionally, it searches long-term memory for appropriate knowledge structures to create meaning in a particular situation. This is done by retrieving activated information from long-term memory, a process that will be called category search in the presented model of creative thinking (see chapter IV.C.2). If information or knowledge structures judged to be worth being stored in long-term memory, short-term memory stores it there, thus expanding the system's knowledge (Seel 2000). These processes are depicted in Figure 17, which illustrates the hypothesised parts of long-term memory, distinguishing between declarative and procedural memory.

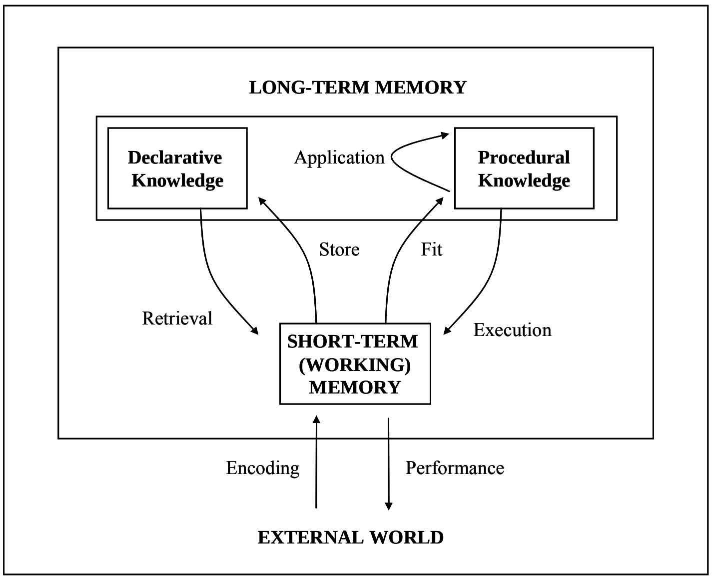

Figure 17 Interplay between Short-term and Long-term Memory.

Still of most relevance to the aspect of limited processing capacity in short-term memory is today Miller's work on chunks (Miller 1956). He investigated the number of chunks of information that could, on average, be remembered by an individual at one time. Thus, this represents the short term capacity for currently active information, and shows that there exists a limit of remembering information in short-term memory. Miller was able to show that capacity was limited not by the amount of information, but the number of chunks, meaning that humans can remember as many words as letters, because although each word is made up of several letters, these can be grouped into a meaningful chunk (Anderson 1990; Seel 2000). Conceptually, Miller's limitation is located in the rehearsal buffer, where only a limited number of slots are available for information. Consequently, if an individual currently has more chunks to remember than slots, items will be lost (Styles 2005). His studies suggested that humans are able to deal with seven (plus/minus two) chunks at one time (Miller 1956).

It should be kept in mind that the presented multi-store model is just one way to mould the human memory, and that there exists a variety of alternative conceptions and variations. For instance, some expanded the model by clearly distinguishing between working memory and short-term memory, in order to account for conscious information processing such as the construction of mental models (Seel 2000). Furthermore, regarding such rather static views like the multi-store model increasing, criticism has arisen since subsequent experimental and neuropsychological evidence have not produced sufficient evidence for such models. For instance, they were unable to account for learning without rehearsal, or the fact that rehearsed material may not be learned (Seel 2000; Styles 2005), or other shortcomings were found (Eysenck 2004). Along these lines, some scholars argue that memory is better thought of as different processes instead of different stores, thus, introducing a single-store model of the human mind.

This approach is related to the theoretical concept of neuronal networks, which was influenced by the findings in neurocomputing on concept learning and other fields (Anderson 1995). For example, Craik and Lockhart (1973) modelled human memory as consisting of different levels of processing. They proposed "[…] that retention is a function of depth and various factors such as the amount of attention devoted to the stimulus, its compatibility with the analysing structures and the processing time available will determine the depth to which it is processed." (Craik and Lockhart 1973, p. 676) In here lies the main cleavage between multi-store and single-store models of human memory: The limited information capacity of working memory in the single-store model is no longer seen as structural, that is recurring on the features of short-term memory, but instead seen as functional. This means that the degree to which information is recognised and memorised is dependent on the depth of processing (Jacoby and Craik 1979). If information is processed superficially, for instance sounds, it rapidly decays; in case the processed information is analysed more thoroughly, it is associated with more durable memory traces (Seel 2000). In summary, such models assume that only one memory system exists and that sensory register, working memory, and long-term memory are only temporary states or modes of activation of this system (Seel 2000). Again, this approach was also criticised by experimental psychologists since depth could only be measured in terms of memory (Styles 2005).

However, disregarding the underlying nature, whether structural or functional, the concluding

Feature	**Sensory Register**	**Short-term Store**	**Long-term Store**
Entry of information	Preattentive	Requires attention	Rehearsal
Maintenance of information	Not possible	Continued attention	Repetition
Format of information	Literal copy of input	Phonemic; probably visual; possibly semantic	Organisation; largely semantic; some auditory and visual
Capacity	Large	Small	No known limit
Information loss	Decay	Displacement; possibly decay	Possibly no loss; loss of accessibility or discriminability by inference
Trace decay	0.25-2 seconds	Up to 30 seconds	Minutes to years
Retrieval	Readout	Probably automatic; items in consciousness; temporal/phonemic cues	Retrieval cues; possibly search processes

Figure 18 shows the commonly accepted differences between the three parts or modes of human memory, in this case experimentally studied for the case of verbal learning. Once again, the figure emphasises the important relation between subject-controlled short-term memory and attention.

However, the three concepts of the multi-store model are able to capture the most important distinctions between recalling in the long run and that of currently active information. Furthermore, they highlight the importance of attentional control and were quite influential for following research and - considering the low importance for the detailed processes in memory for the present work - should be sufficient to provide an overview on this topic. This chapter has briefly outlined how the human mind might be conceived; however, nothing has been said so far about the content of our memory, our actual knowledge. Hence, the following paragraphs will focus on meaning-based knowledge and the way it is stored in human memory; in particular conceptual knowledge and its prominent concept of schemas is introduced. The considerations conclude with a formal notation of conceptual knowledge which is necessary for modelling opportunity recognition in chapter V.

Feature	**Sensory Register**	**Short-term Store**	**Long-term Store**
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Maintenance of information	Not possible	Continued attention	Repetition
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Figure 18 Commonly Accepted Differences between the Three Stages of Verbal Memory (Craik and Lockhart 1972).

If information has been perceived and entered the cognitive system it is processed, but it is also crucial how this information is represented in the system and builds up our knowledge. So far, it has only been said that information and knowledge are somehow ‘represented’ in an individual’s memory, and not explained in detail what is meant with this expression. Basically, it can be distinguished between perception-based and meaning-based representations; the former preserve much of the original perceptual experience's structure, while the latter are quite abstracted from the perceptual details and simply encode the experience's meaning (Anderson 1995). Perception-based representations are assumed to take the form of mental images, which are representing an object's physical appearance and the configuration of objects and features in space. In turn, meaning-based knowledge representations aim at storing propositional knowledge about the semantic relations among objects, features, and events (Leary et al. 2003).

In fact, the notion that there exist internal representations of knowledge is probably the most significant difference between behaviourism and cognitive psychology since it is hypothesised about states or contents of the black box. Most generally speaking, a representation is something that stands for something else since it is responsible for representing an object or situation in the human brain (Styles 2005). This broad definition simultaneously explains why representations are an important topic in other fields, in particular philosophy and computer science: Everything that is assumed to represent something in the external world has to be described in a formalised manner (see for an overview Sowa 2000). For the human mind, the majority of researchers supports the notion that there are separate internal representations for verbal and visual information (Eysenck 2004), as, for instance, dual-coding theory: This model is based on research on human memory, where it is often found that memory's pictorial material is superior to memory for verbal material. Consequently, the dual-coding hypothesis proposes that mental representations could be coded both visually and verbally, as shown in Figure 19 (see for instance Paivio 1975; Paivio 1986).

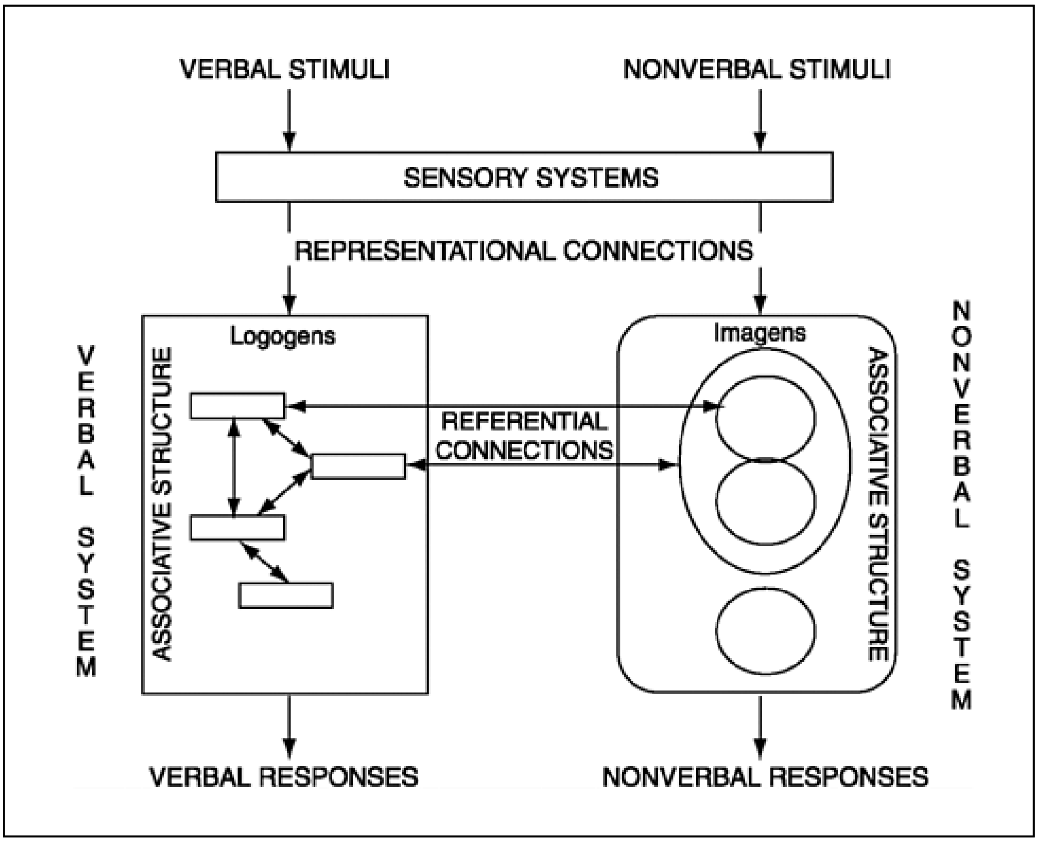

Figure 19 Pavio's Dual Coding Model (Pavio 1986).

Accordingly, subjects given a sentence usually tend to superior memory if they develop a corresponding image of this sentence (see e.g. Anderson and Bower 1973; Roland and Friberg 1985; Santa 1977). But since scientific insights about knowledge representation in the human mind is quite thin, there is still a vivid controversy going on within the community. For example, it is discussed whether knowledge representations have a visual form analogous to the objects they are referring to in the real world (analogous representation); however, such discussions are omitted here (see further Kosslyn 1980; Shephard and Metzler 1971).

In the following considerations it will not be discussed in-depth, which processes could be involved in constructing representations, but only briefly referred to categorisation theory, which was proposed as an explanation of the cognitive process that underlie the formation of concepts for natural objects (Mervis and Rosch 1981; Rosch 1978; Rosch and Mervis 1975). Notwithstanding, this general theory can be applied to research in economic settings (see e.g. Dutton and Jackson 1987). However, it should be noticed that the principal reason for the interest in knowledge representation is that the way in which information is represented can affect the way it is processed. Nevertheless, for this purpose it is less interesting to discuss verbal or visual information representation or processing in detail. Rather, meaning-based knowledge representations will be focused here since models like Paivio’s make no statement how associative structures of memory look like or, in other words, how knowledge is organised in the human mind. These representations extract what is significant to the individual about an event and discard many of the unimportant details. Generally, two types of meaning-based representations can be identified: (1) propositional structures that encode the significant information about a particular event, and (2) conceptual structures that represent categories of events and objects in terms of their typical properties.

Very generally, the term of human (1) propositional knowledge embraces information if something is the case, i.e., meaning is given, which is highly person-relative (Moser 1989). For instance, empirical evidence shows that humans normally extract meaning from a linguistic message and do not remember its exact wording (see e.g. Wanner 1974). Of course, humans are able to memorise verbal information when they pay attention, but in any case memory for such information is poorer than memory for meaning. Further, research has shown that human memory capacity often seems much greater for visual than for verbal information. But even in such case, it appears to be some interpretation that is remembered and not the exact picture. Thus, it proves useful to distinguish between meaning of a picture and its physical picture (Anderson 1996); a number of experiments point to the utility of this distinction (see e.g. Bower et al. 1975; Mandler and Ritchey 1977). Beyond, there is evidence that subjects initially encode many of the perceptual details of a sentence or a picture but then tend to forget this information quickly. An example as to visual information is the (non-) retention of a picture's left-right orientation (Gernsbacher 1985). Finally, only information about meaning or interpretation is retained; but how is such knowledge now assumed to be stored in the human mind?

It is stored in form of propositions, a concept that is borrowed from logic and linguistics; it is the smallest unit of knowledge that can function as a separate assertion. In logic it is therefore the smallest unit about which it makes sense to make the judgment true or false (Anderson 1995). Based on this general notion, propositional representations have become a common method of analysing meaningful information in cognitive psychology (see for instance Anderson and Bower 1973; Clark 1974; Frederiksen 1975; Kintsch 1974; Norman and Rumelhart 1975). Propositional analysis most clearly applies to linguistic information and is presented here in this context (building on the example of Anderson 1995).

Lincoln, who was president of the USA
during a bitter war, freed the slaves.

Figure 20 An Example for a Proposition.

The information of the sentence in Figure 20 might also be given by the following simpler sentences: (1) Lincoln was president of the USA during a war; (2) the war was bitter; and (3) Lincoln freed the slaves. If any of these simple sentences were false, the whole (more complex) sentence would not be true. Consequently, the complex sentence's meaning is corresponding to the three propositions, which express a primitive unit of meaning each. However, it should be noted that persons do not remember simple sentences in their exact wording, but rather information is represented in memory in a way that preserves the primitive assertions' meaning (see further examples in Bransford and Franks 1971; Kintsch 1974).

In cognitive psychology, propositions are often illustrated in form of networks, building up more complex forms (e.g. Anderson 1976). In such a propositional network, each proposition is represented by an ellipse, which is connected by labelled arrows to its relations and arguments. Propositions, relations, and arguments are called the network's nodes, and arrows are called links, connecting the nodes. In turn, the links are labelled in order to indicate that it is pointing to the relation node. Reconsidering the example given above, a possible propositional network is given in Figure 21.

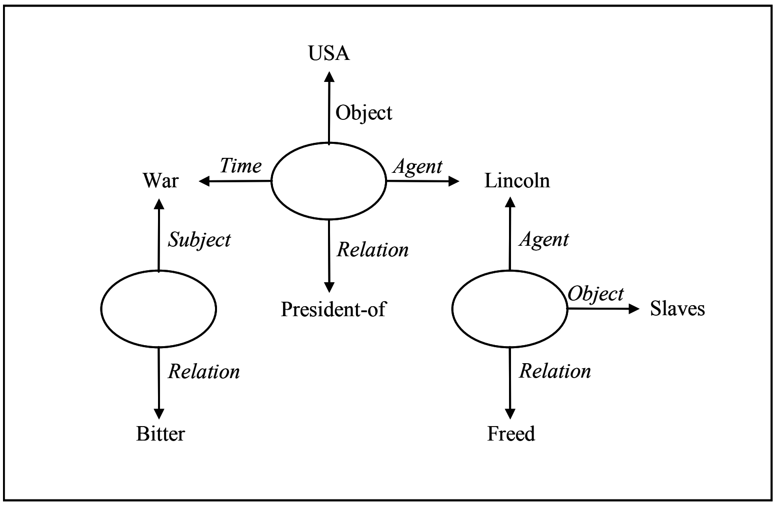

Figure 21 Network Representation for a Proposition.

The overlap clearly indicates that the networks are interconnected parts of a larger network; however, it should be noticed that the spatial location of elements is irrelevant to the interpretation. One of the main advantages of such a network structure is that they are capable of showing hierarchical relationships where one proposition occurs as a unit within another proposition. Thus, such a figure can show that a proposition is caused by another; such constructs have been named connectionist representations (Anderson 1995).

While propositional representations abstract by deleting many of the perceptual details and only retain the important relationships among the elements, there exist other abstractions like that from specific experiences to general categorisations of that class of experiences' properties. Such abstracted processing of information is called (2) conceptual knowledge. There are many possibilities to represent such knowledge that stores predictable information about a category's instances (Anderson 1995). However, the neurobiological concept of human memory as built up by auto-associative networks (see Kohonen 1984) and neural networks has had a strong impact on research on human knowledge structures: These are assumed to be permanently stored in memory traces that are simultaneously subject to change. In order to recognise and understand new information such content must be activated (Seel 2000). This approach assumes that information represented is content addressable, i.e. which means it can be accessed by only a partial description of an item or object. Thereby, they provide a more flexible retrieval of stored knowledge. Imagine, for example, someone asking which German dictator caused World War II. The answer is Adolf Hitler. At the same time, the individual might know that he was born in Austria, fought in World War I, was imprisoned, etc. Any of these questions regarding the person allows the individual to access its knowledge about Adolf Hitler (Anderson 1995).

Generally, categories are conceptual knowledge structures that store properties about a set of objects that exhibit a certain degree of similarity as to these properties. It is asserted that cognitive categories are built up by objects with similar perceived attributes and that they reflect objects (whatsoever) in the environment (Dutton and Jackson 1987). Categories are crucial to human interaction, in particular communication since information is summarised by a category name or label that is shared by the interacting agents (Cantor and Mischel 1979). For instance, if persons are talking about a house it can be assumed that they share the same prototype of what characterises a house, for instance having a roof. Furthermore, such categories reduce the complexity of incoming stimuli by organising objects into meaningful groups (Dutton and Jackson 1987). Thus, a category comprises of similar, non-identical members that share some common attributes, but are differentiated by dissimilarities among many other attributes: Humans dispose of prototypes that are made up of the shared features or attributes (Rosch 1975, 1978). Again, it should be kept in mind that conceptual knowledge organisation affects the whole cognitive system by what has been called before cognitive constructivism:

Various studies were able to provide evidence for the conjecture that category-consistent information is better recalled than category-inconsistent information. Even if it is still unknown whether this is caused by selective attention or forgetting, it has an important impact: Once an object in the external world is put into a category, the subsequent cognitive representation built is an inaccurate, simplified picture that matches the category prototype rather than did the original stimulus (Dutton and Jackson 1987). Similarly, it has been shown in experimental studies that individuals tend to a behaviour that is called 'gap-filling' (Johnson et al. 1973; Cantor and Mischel 1977). This names a constructive error occurring in situations in which a stimulus only offers incomplete information about an object. Then, individuals tend to fill the gap of missing information with category-consistent information. In other words, general information about a category is used to infer the presence of specific attributes typically associated with a particular member (Dutton and Jackson 1987). Similarly, the constructive error of distortion occurs in case available information is ambiguous. This phenomenon has been sufficiently studied to assume that individuals process incoming information according to the category they have judged the object in the external world to belong to (Carmichael et al. 1932).

Another popular manner to represent conceptual knowledge is in form of networks, assuming that subjects store information about various categories; for instance, about animals the categories of canaries, robins, fish, mammals, etc. might be stored. The approach of semantic networks apparently refers to semantic knowledge, which is knowledge about facts (Tulving 1972). In such hierarchical structures of categories facts can be represented. In other words, the semantic knowledge contains defined traces of attributes that are permanently attributed to objects (Prinz 1983). These can be - at least - subdivided into primary attributes that mark immediate characteristics of objects, for instance form, location, colour, size, etc., and secondary attributes that provide a secondary characterisation of such objects, for example nice, good, can be lifted, etc. (Seel 2000). In Figure 22 such a network is shown, representing information such as that a shark is a fish and a fish is an animal by linking nodes for the two relevant categories with so called isa links (Anderson 1995).

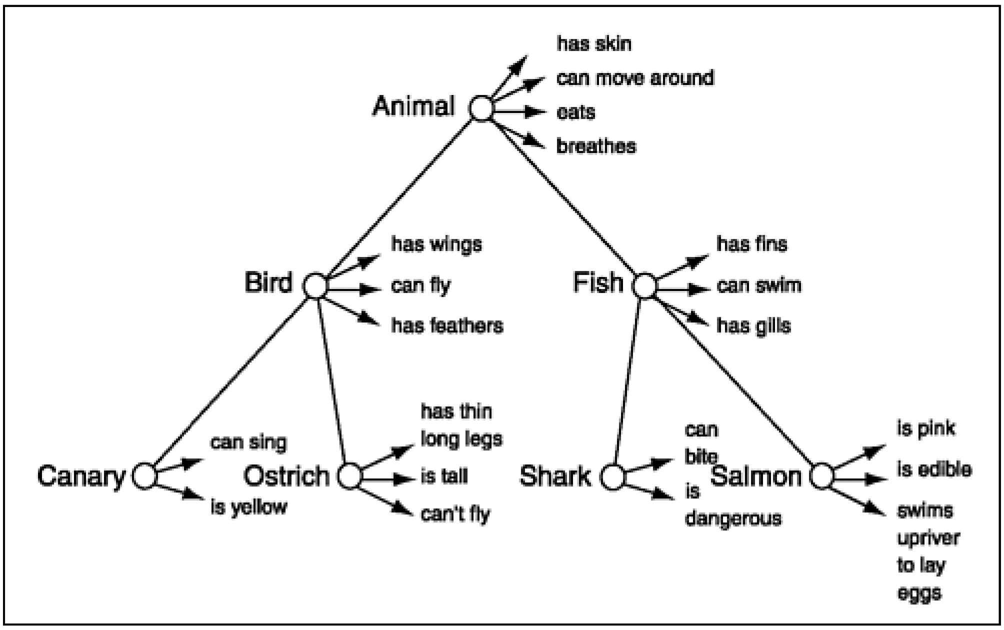

Figure 22 Memory Structure for a Three-level Hierarchy of Animals (Parkin 2000).

Each level in Figure 22 corresponds to a category, exhibiting properties that apply to them. Properties true for higher-level categories are automatically regarded true for lower-level categories. It could be said that activation spreads from node to node within the hierarchical structure, called the concept of spreading activation. If, for instance, 'canary' and 'can sing' are activated, excitation spreads to other connected notes. A positive response is given, when these two sources of activation meet (Styles 2005). In more realistic terms, empirical research has shown that in case a fact about a concept is frequently encountered, it is stored with that concept directly, instead of inferring it from a more general concept. Furthermore, the more frequently encountered a fact about a concept is, the stronger it will be associated with the concept and the faster it is verified. In turn, verification of facts, which have to be inferred from a more super-ordinate concept, takes a relatively long time (Collins and Quillian 1969).

A semantic network represents a rather economical way of representing knowledge as it removes the necessity to store all information about the properties of the concept at hand. More recently, it turned out that human knowledge's representation about categories in form of semantic networks is not sufficient. For instance, the result of the false statement 'a bird can swim' is not given in such a representation since it should take a long time, or even might be impossible, for activation within the network from 'canary' to 'can swim' (Styles 2005; for further problems see Rosch 1973; Rosch and Mervis 1975). Joining to criticism on the organisation in nodes of semantic memory, it came to a development of theories that account for typicality effects and propose that category membership is rather computed by comparison of features (e.g. Smit et al. 1974). Other researchers distinguished representations in the meaning of objects from operators, standing for cognitive operations that are stored for executing an operation of any kind (Dörner 1976). The encoding and retrieval of such procedural knowledge is seen analogous to the previously described processes. However, such knowledge structures of operators store how, under which conditions, and with which consequences will be intervened in a real life situation. Therefore, encoding of an operation contains exact constructions to execute an operator in case specific conditions are met (Seel 2000). Nevertheless, any model assuming that knowledge about objects or concepts is stored in terms of attributes has problems in determining which features are necessary and sufficient for category membership (Styles 2005). In fact, knowledge is more sophisticated, flexible, and interdependent than it is captured by the models introduced so far; therefore, other, more sophisticated category representations have been conceived in recent years, especially schema theory became more and more prominent.

3. Schemas and Mental Models

Philosophically, already Kant used the term of schema in a provocative but rather unclear manner (Rumelhart et al. 1986). In a psychological context the notion of schema was first used by Bartlett (1932) and Piaget (1952) who both described data structures in memory representing knowledge about concepts (Dutton and Jackson 1987). Barlett already proposed that knowledge is held in structures called schema. He alleged that individuals remember and interpret new information in terms of such extant knowledge structures, underlining the conjecture that cognitive processes do not operate in isolation, but instead are embedded in the individual’s environment, thereby reducing ambiguity in situations by applying knowledge in schema (Styles 2005). Bartlett investigated this processes by showing subjects ambiguous drawings resembling two different types of objects. Afterwards, subjects were asked to draw what they saw. Depending on their classification of the object seen, they drew one or another view: This suggests that individuals do not remember a picture itself, but rather its interpretation.

However, Bartlett’s concept has long been criticised for its vagueness and Piaget’s (1952) use of the term schema was difficult to interpret consistently (Rumelhart et al. 1986). Building on this argumentation the notion of the schema has been rejected and shunned by mainstream experimental psychologists until the mid-1970s. Since then, the concept has been revived by several attempts to offer a more unambiguous interpretation in terms of explicitly specified computer implementation or, similarly, formally specified implementation of the concept (Rumelhart et al. 1986) Such formal, scientific approaches were, for instance, the concept of the frame postulated by Minsky (1975), the concept of the script introduced by Schank and Abelson (1977), and more explicit notions of the schema, developed by Bobrow and Norman (1975) and Rumelhart (1975). All these scholars agreed on the conviction that activities of the human mind can only be explained if conceptualised larger and more structured than so far.

The answer is seen in higher-level conceptual structures that represent complex relations implicit in our knowledge base. The underlying idea is that a schema is a data structure for representing the generic concepts, which are stored in memory (Minsky 1975). There exist schemas for generalised concepts underlying objects, situations, events, actions, and sequences of action. Put briefly, schemas could be seen as models of the outside world. They guide information processing by determining, which of these models stored in memory best fits incoming information. In the end, consistent configurations of schemas are identified that, jointly, offer the best account for input perceived in the IPS, i.e. the best-fitting-categories are specified. This idiosyncratic configuration of schemas constitutes the input's interpretation. Consequently, considering the main function of a category - to store predictable information about instances of that category - it is not enough just to list the common properties (like in semantic networks) since such lists ignore the interrelational structure. A schema takes this circumstance into account by assuming that a concept (like the bird) is defined by a configuration of features. Each of these features involves specifying a value the object has on some attribute; for instance, birds may vary as to their size from (estimated) 3-4 cm to 3-4 m; hence, each bird recognised can be specified by a value within this range of the attribute of size.

Nevertheless, the idea was not dealt with until the 1970s, when several authors presented slightly different interpretations of schema (Abelson 1975; Minsky 1975; Rumelhart 1975; Schank 1975). Actually, these models all share a number of common features; in particular they all regard a schema as a generalised concept that underlies objects, situations, events, sequences of events, actions, and sequences of actions (Rumelhart and Norman 1985). Some researchers even claim that an individual's entire knowledge is organised in schema (for example Neisser 1979). However, all scholars doing research on schemas are confronted with a dilemma: They are the mind's structure, but they are simultaneously very flexible since they must be sufficiently malleable to fit around almost everything (Rumelhart et al. 1986), which raises the following question: "How can we get a highly structured schema which is sufficiently rich to capture the regularities of a situation and to support the kinds of inferences that schemas are supposed to support and at the same time is sufficiently pliable to adapt to new situations and new configurations of events.” (Rumelhart et al. 1986, p. 20) The answer simply is that there is nothing like a representational object of a schema stored in human memory. Rather it is just a momentary configuration of a network of a large number of much simpler elements which are interacting, as is described in the concept of mental models.

In this sense the emergence of another type of knowledge representation, mental models of the world and their relation to schema can be explained (Johnson-Laird 1983). For this the cognitive system executing cognitive processes could be divided into two parts or sets of processing units. The first part, the interpretation network responsible for processing information from the external world, receives inputs and transmits them to knots of the remaining network. These knots contain specifications of an appropriate action or reaction, which effect and alter the input. The second part of the system is the mental model of the world, in which an individual acts. This part itself is seen as a network and its input is a specification of the action an individual considers to take. Its product is an interpretation of what might happen if we execute this action (Rumelhart et al. 1986). Thus, the main function of a mental model is to mentally execute an action, evaluate the consequences, interpret these, and derive conclusions, i.e. allowing a mental simulation (Seel 2000). See for an illustration of the hypothesised relation between mental models, the interpretation network, as well as inputs and outputs Figure 23. According to this model, it can be assumed that schemas are created through actions of the interpretation network and provide the fundament and the interpretative framework for the construction of mental models (Seel 1991). In other words, mental models are here regarded as parts of the interpretation network, helping the human mind to make sense of information coming from the external world.

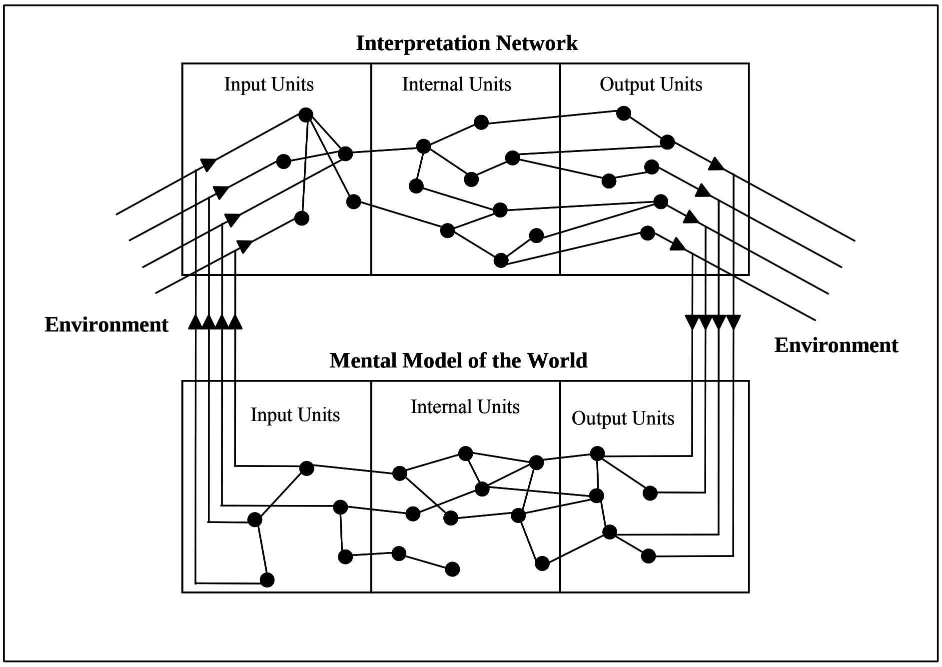

Figure 23 The Interpretative Network and Mental Models (Rumelhart et al. 1986, p. 43).

Defining schemas as knowledge structures serving the human mind in different circumstances, general functions can be identified (Mandl et al. 1988): First of all, schemas (1) control an individual's attention in the sense that they influence the distribution of attentional resources on schema-related or non-related information. Secondly, they have an (2) integrative function since they provide a framework for the integration of new information to be processed. This framework creates coherence and comprehension for making sense of such new information. Thirdly, it can be stated that schemas have a generic character since they possess variables; this means they have an (3) inference function leading to sense-making and meaningful inferences or conclusions. This inference function can be deducted from the notion that a schema provides a plan for solving a task by directing thinking processes und building specific expectations about potential supplements to incomplete updates of schemas. Thereby, schemas facilitate controlled thinking processes since the solution to a problem is not found through undirected associations, but rather through searching and finding information that can be put in a schema meaningfully in order to complete or update it (Seel 2000). This partially corresponds to the integrative function and attention control function mentioned before. The former function implies that new information is better understood and retained if it can be integrated into a blank space of a schema, thus, serving as a comprehension- and coherence-making framework. At the same time, this means that attention is directed to information that is somehow related to such schemas (Mandl et al. 1988).

It is argued that schemas represent an individual's generalisable and abstract knowledge accumulated in various single experiences of objects, persons, situations, and actions (Seel 2000). This definition implies that schema are acquired and constructed through a process of internalisation: Traces of memory are created through a proceeding concretion of concrete single experiences' common attributes, thereby aggregating its contents to comprehensive, and simultaneously more abstract, interpretation networks (Aebli 1980). Such schemas tend to be activated as a kind of information bundle, whenever attributes of a new experience 'fit' to the ones contained in a trace of memory. Finally, this process of aggregation to abstract attributes leads to the emergence of abstract knowledge structures, whose variables can be filled in by concrete information from different domains (Seel 2000). The process underlying this concept of knowledge structuring in the human mind has been modelled from an information processing perspective by Rumelhart et al. (1986).

The process starts with input coming into the system from the external world, activating a set of units. These are interconnected with each other, forming a kind of (constraint-satisfaction) network in the interpretation network (see top left-hand side in Figure 23). The starting state of the system is determined by theses inputs, which also determines how good the fit of the internal representation with the input is perceived (goodness-of-fit-landscape). Afterwards, the system moves towards one of the goodness maxima, i.e., has specified one representation that best fits the input. It is further assumed that the system is relatively stable, when such a state is reached; that means there is little tendency for the system to migrate towards another state.

The notion of a state needs some more consideration: States of such a system are product of an interaction among many groups of units. Such groups tend to act in concert and to activate each other. When activated, they are assumed to inhibit the same units. Such a stable pattern of units could be seen as a particular configuration of a number of overlapping patterns. It is determined in its configuration by the dynamic equilibrium of all activated sub-patterns that interact with each other and the inputs. These states of maxima in goodness-of-fit space are interpretations of the input or configurations of instantiated schemas. In other words, they are those states that maximise a particular set of constraints active at that moment in time.

The human mind is furthermore assumed to hold a goodness-of-fit function for different configurations. Thus, depending on context and input, the system will initially be at one point in this function and find the closest maximum. The degree of structure depends on the tightness or strength of the coupling among the coalitions of units, which correspond to the schema at hand. In this particular notion a coalition of units that tend to work together closely resembles to a schema in the conventional (stationary) view, while rather loosely interconnected knowledge structures are more fluid and less schema-like. Hence, if the former case holds true for a rather large subset of units, a schema provides a very useful and accurate description. This also implies that the memory is not built up by schemas that are stored, but by a set of connection strengths, which, when activated, might generate stable states that correspond to instantiated schemas (Rumelhart et al. 1986). This general process is applied to all kinds of situations. Depending on situations and knowledge involved, different types of schema can be identified: These might be so called 'scripts" for objects and occurrences or operations, 'frames' for situations, 'plans' for actions, up to 'grammars' that represent regular structures of stories and tales (Schank and Abelson 1977). But again, all these concepts share some central characteristics that are discussed hereafter.

Firstly, as already mentioned, schemas exhibit attributes for which they adopt different values. As result of the internalisation process, individuals possess default values for each attribute. In situations of incomplete information this allows inferring about attributes of the schema for which individuals do not have information in this particular case, a process called default reasoning (Cheng and Holyoak 1985). For example, almost everyone will recognise a human face in comic, even if there is some 'information', for instance ears, not given. Again, this notion is apparently based on a relativist ontological stance; it should be evident that in a constructivist perspective this process would have to be conceptualised somehow different and, more importantly, default reasoning becomes a central issue modelling the external world's subjective perception.

Further, an individual's schemas are hierarchically organised according to different degrees of generalisation and abstractness. Thus, it can be said that schemas embed each other in such structures. Schemas have a core of relatively fixed and further variable features. While the former are features that must inevitably be present for recognising a schema, the latter depend on the instance at hand (Rumelhart et al. 1986). For example, such core features for 'going out to eat in a restaurant' would be, for instance, 'sitting at a table and eating food'; in turn, it is variable whether it is 'self-service', or 'waiters serving'. This also applies to the type of food eaten (e.g. lamb), which may be contained by another schema (e.g. Indian or Greek food) (Rumelhart and Norton 1985; Schank and Abelson 1977). In such a hierarchy of schemas, the lower end is made up by rather simple schemas, in the sense that they aggregate elementary attributes and concrete items that cannot be further decomposed in more elementary units in a given context (Newell and Simon 1972). The higher in the hierarchy, the more complex becomes the schemas' level of abstractness. In this context local schemas are discriminable from global schemas, differing in the degree to which they aggregate information for schemas of different contexts. The former represent limited knowledge, involving a small number of schemas, while global schemas, are of a rather abstract nature and include more such concepts. Global schemas can be updated by single experiences, but lose details of local schemas included with an increasing degree of abstractness (Rumelhart et al. 1986).

In making sense of incoming information, schema are active in recognition working top-down the hierarchy to interpret and make sense of scenes, situations, stories, or social institutions (Seel 2000); also called conceptually-driven processing (Bobrow and Norman 1975). More operationally seen, schemas are category systems that can be structured along a vertical and a horizontal dimension (Rosch 1978). As described above, in the vertical dimension each higher level is inclusive of the levels below. This dimension could be divided into three levels: The highest, most abstract or inclusive level is the superordinate one, containing the basic level, which, in turn, comprises subordinate categories (Dutton and Jackson 1987). The superordinate category of ‘organisations’ might serve as example that could be hypothesised to comprise the basic level categories of ‘profit’ and ‘non-profit’. Subordinate categories could be insurances or internet providers for the former, and hospitals or funds for the latter. In this example, ‘profit’ and ‘non-profit’ are among the different horizontal categories at the basic level (Dutton and Jackson 1987).

Summarizing this, schemas can represent knowledge at all levels of abstraction; they do not only apply to concrete meaning-based examples, but also to more abstract constructions like democracy or justice that rather represent knowledge than concepts (Rumelhart et al. 1986; Seel 2000). It is assumed that higher-level, more general, and more abstract schemas within this hierarchy impose constraints on subordinate schemas, regarding their scope and valid transformations. Simultaneously, attributes are handed down from higher to lower levels (Seel 2000). Consequently, an individual does not incorporate a definition of abstract terms such as democracy, but what it knows about them (Styles 2005).

It should be noted that schema are not passive cognitive structures that are stored in memory and can be retrieved if a situation requires it (Hermann and Hoppe-Graff 1988). They should be rather seen as active processes that result from the activation of linkages within complex interpretation network (Arbib and Hesse 1986); thus, they are specific configurations of such network structures, which could be seen as updated schemas (Rumelhart et al. 1986). Another important characteristic of schemas is that they are a means for insight, which target on an evaluation of their ability to adapt to the information that is processed. This assumption implies that schemas vary as to their flexibility, which results from the cohesiveness and rigidity between the constitutive units. The closer and more rigid the linkage, the stronger activate the constitutive elements each other and the more rigid is the schema's structure. The weaker the linkages, the more fluent and variable is the structure, and the easier it is for it to run through the cognitive system (Rumelhart et al. 1986).

Schemas...

- ... are an individual's generalisable and abstract knowledge accumulated in various single experiences of objects, persons, situations, and actions.
- ... have attributes, for which they can adopt different values and hold default values.
- ... are embedded and build up a hierarchical structure from local (specific) to global (more general) schemas, different as to their degree of generalisation.
- ... interpret incoming information top-down in the hierarchical structure, resulting in conceptually-driven processing.
- ... represent knowledge on all levels of abstractness.
- ... are seen as active processes since they are understood as an activation of linkages within complex interpretation networks.
- ... differ regarding their degree of flexibility, which is a function of the cohesiveness and rigidity of the constitutive units. The stronger and inflexible the linkages between them, the less fluent and flexible is the structure.

Figure 24 The Central Characteristics of Schemas.

The main characteristics marking the concept of schemas are summarised in Figure 24. However, notwithstanding the strong influence schema theory had for information processing approaches, it is criticised for several reasons, e.g. for not providing testable predictions such as how it is specified what knowledge is included in a schema or how a schema can act top-down to interpret situations (Styles 2005). Further, advocates of connectionist representations argue that knowledge is distributed among knots and connections (among a network) and no memory directly corresponds to a schema (Seel 2000). However, these two views are not mutually exclusive since schemas can be understood as characteristics of complex networks (Rumelhart et al. 1986). In summary, it can be stated that schema are aimed at discharging the information processing system by guiding it through systematic searches for schema-related information (Seel 2000). Therefore, in this context information processing means to determine which model best fits the incoming information (Rumelhart and Norman 1985), thus, resembling to the view that individuals interpret the world in terms of what is known and expected, emphasising the importance of memory on perception (Styles 2005). In the following it is often referred to knowledge structures or concepts; if so, the reader should have a schema in his mind's eye since providing a general and widely accepted concept for further use in theorising. However, in order to operationalise knowledge structures for a cognitive model of opportunity recognition in chapter IV the following considerations deal with the issue how knowledge structures can be represented.

As already said, it was Minsky (1975) who introduced the concept of frames for representing knowledge based on the idea of schemas. Many other possibilities exist to do so, but this approach puts a particular emphasis on structuring and organising knowledge structures (Sowa 2000). This characteristic and the fact that it is a relatively simple, general, and popular manner to represent knowledge, virtually suggest its use for the present work. Frames are used in artificial intelligence and intended to facilitate computing of information processes. Therefore, it is apparently a formal approach based on the fundament of logics. As argued in chapter II.A.1 such formal approaches are principally incapable of accounting for singularity and endogenous change. However, it is one of the main arguments alleged in the present work that singular events in economic systems do not alter the general structure of the underlying knowledge structures on a non-textual level. In the terminology of frames, creative humans are assumed to change the values of knowledge representations to come the novel means-ends frameworks and not the categories themselves. By introducing the concept of frames and the adjustments that must be made for a subjectivist interpretation, this differentiation should become clearer.

In any database theory categories must exist that determine what can be considered by the system using the knowledge stored; such categories might be called domains, types, classes or sorts but all define an object as such. In such approaches it is assumed that 'being' means to be the value of a quantified variable (Quine 1992). Many different frame systems have been developed since Minsky introduced the general concept: The present work selects a general and flexible system for developing its model, the Generic Frame Protocol (GFP) (Karp et al. 1995). However, in developing a frame the first step is to identify which variables characterise an object as such, i.e. which ontological statements are of relevance for an individual to recognise and use an object as such (Sowa 2000). Each relevant variable gets a slot in the frame, which are in turn restricted by a facet that defines the types of variables storable in a slot. Thus, the relevant variables and their corresponding types define a general template for an object. For introducing the general idea and the notation used an example about the knowledge representation about a truck taken from Sowa (2000) is given in the following, which resembles to another rule-based language called CLIPS (see Coppin 2004). Figure 25 depicts the template frame for trucks in general.

```
(defineType                Truck
     (supertype            Vehicle)
     (unloadedWt           (type WtMeasure) )
     (maxGrossWt           (type WtMeasure) )
     (cargoCapacity        (type VolMeasure) )
     (numberOfWheels       (type Integer) )
```

Figure 25 Template Frame of Truck.

The second line or slot of the frame defines a truck to be a member of the superordinated set of vehicles; by introducing a supertype it is therefore possible to implement hierarchical network structures. A truck in this particular knowledge structure is defined by its unloaded weight (`unloadedWt`), it maximum gross weight (`maxGrossWt`), its cargo capacity (`cargoCapacity`), and its number of wheels (`numberOfWheels`), which are all shown on the left-hand side in Figure 25. On the right-hand side, each slot exhibits a facet that shows which values are vaild for each variable. By allowing a hierarchical structure the GFP allows to define the facets more precisely. The maximum valid number of wheels could be limited to 18 for example. Put differently, the left-hand side defines the types of representational elements necessary, and the right-hand side the representational elements acutally included. However, generally such templates define the set of possible states that an instance of the class of trucks can have. The representation *f* of a specific truck, say the only fire truck of a small village, could for instance look like shown in Figure 26.

```
(defineInstance            FireTruckBornheim
     (supertype            Truck)
     (unloadedWt           (2 tons) )
     (maxGrossWt           (5 tons) )
     (cargoCapacity        (4000 litres) )
     (numberOfWheels       (8) )
```

Figure 26 Instance Frame of Fire Truck in Bornheim, Germany.

Apparently, another template for fire trucks in general (`defineType FireTruck`) could be defined, but these two examples for a template and a instance should serve well enough to introduce the central terms of templates, instances, variables, types of variables, and values. However, it should be noted that the general nature of frames allows to describe anything storable formally; this implies that not only states but also events in cognitive processes can be described by such a notion.

Further, and once again, it must be underlined that such frames in the way they are used in artificial intelligence cannot account for creativity since they are strictly based on logic in the sense explained in chapter II.A.1 and, therefore, define a finite set of potential states for every system, object, or whatsoever can be represented. However, it has been pointed out that the human mind is fundamentally different to such a conception and can endogenously alter such knowledge representations. It is argued here that knowledge representations and the central variables are not changed on a general level; nevertheless alterations are possible. However, the main variation of variables and facets, i.e. of variables' valid values, takes place on hierarchical knowledge structure's lower levels. It is assumed that on a sufficiently general level the relevant variables are given. On the contrary, the creative element is not only considered by changing values of a knowledge representation, but also by the expansion of facets, i.e. the set of permitted values of a variable, thereby altering the set of possible states in an ex-ante unconceivable way. Consequently, the present work aims at identifying general values of economic situations that are themselves not subject to change and allow a scientific approach in the sense of axiomatically independent networks of theories (Herrmann-Pillath 2001).

The frames developed here can be easily integrated into the way of modelling cognitive processes in terms of Petri nets as briefly introduced in chapter III.A.3, serving as a way to model states in such a graphical notation. The particular importance of the problem representation or the mental situation for economic decisions and, thus, action has been emphasised throughout the foregoing chapter II.A. Research in the field of cognitive psychology has also proven the role of such concepts in human decision processes, although most research as to the categorisation of information has focused on physical objects that occur in the natural world instead of social problems (Medin and Smith 1984). However, there were also important works on social objects, situations and events, corroborating the stance of the present work (Cantor et al. 1982; Tversky and Hemenway 1983). Consequently, building on this, a template frame of economic problems can be developed, which is dealt with in chapter IV.B.2 depicted in Figure 33. The probably most difficult task about conceiving such a template of economic problems is to decide, which slots or variables necessarily must be included. The central question is, which slots are relevant to distinguishing significantly different types.

C. Creative Thinking

1. Defining Creativity

Even though in the course of the previous chapters on human thinking implicitly several attributes of creativity have been mentioned, it is not quite clear if - and if so how - the creative thinking process is different from the non-creative thinking process. Explaining such differences between general human thinking and creative thinking is quite essential since the term creativity is often used in everyday life and scientific discussions, but mostly remains a fuzzy concept. Therefore, in the following some main theoretical considerations and empirical evidence are provided that delineate the phenomenon, and the way it can be modelled in the chosen paradigms or views of information processing and problem-solving.

Several theoretical views could be identified as to how the relation between the creative and the non-creative process could be seen. Lubart (2001) distinguishes three different angles from which it can be approached: The (1) dichotomy view states that the processes are indeed different, therefore justifying the establishment of a dichotomy. This implies a need to develop different models for both processes. The main question arising here is how it can be accounted for different levels of creativity. Alternatively, the (2) continuum view assumes that there is no dichotomy between the creative and the non-creative process. If so, both could be placed on a continuum with several parameters that account for the output's creativity. Implicitly, this would also provide a formal explanation for different degrees of creativity. In another concept, the (3) input view, differences regarding creativity of a process outcome are attributed to the information that functions as input to the process. This view implies that the same sequence of thoughts and actions can lead - depending on the input - to different degrees of creativity. It resembles to a formula, linking the outcome directly to the input of the process. Anyway, this is a rather theoretical question since all mentioned process models can be constructed, respectively explained, from all three viewpoints. Nevertheless, this general aspect is fundamental for the present work since a model shall be presented that accounts for different degrees of 'creativity' in the recognition or construction of entrepreneurial opportunities.

Supporting the theoretically motivated distinction, empirical results concerning the creative processes' specific nature have also been collected in the last decades. Based on previous studies, Mumford et al. (1991) identified four ways, in which creative problem-solving basically differs from other kinds of problem-solving efforts: (1) Creative thinking typically occurs in ill-defined situations, i.e. the goals, information, and resources to be used are not clearly specified. Instead, this has to be done by the individual at hand, forcing him to engage in problem finding or problem construction (Frederiksen 1984; Getzels and Csikszentmihalyi 1976; Mumford et al. 1991). (2) Standard problem-solving usually involves the application of previously acquired solutions (Nutt 1984); for instance, the satisfycing theory of Cyert and March (1963) points out that individuals often satisfice applying the first available solution they identify. However, since creativity or creative problem-solving requires a novel solution that is supposed to solve the problem at hand, an existing one (often the first available) typically not leads to creative outcomes (Mumford et al. 1991). Rather the generation and exploration of novel, alternative problem solutions, often called divergent thinking is required (Guilford 1950). Subsequently, it is necessary to evaluate the generated alternatives according to their potential utility in yielding viable solutions; this evaluation is called convergent thinking. Divergent and convergent thinking are applied in an integrative action; consequently, evaluation does not preclude the generation and application of potentially viable alternatives (Isaksen and Parnes 1985).

(3) Further, individuals are likely to cycle through multiple stages of divergent and convergent thinking in creative problem-solving-efforts, while non-creative problem-solving often proceeds in an additive fashion, using simple activation, generation, and application mechanisms (Langley and Jones 1988). This is because initial solutions are refused and/or extended, thus, demanding more attention or resource demands and requiring more active and flexible controlled processing (Ackerman 1986). (4) Finally, as mentioned before, thinking is based on existing knowledge since it is assumed that information is stored, recalled, and understood through the application of categorical knowledge, e.g. schema (see chapter III.A.1). These extant categories were built up by prior learning, albeit they are applied in a totally new situation and, thus, unlikely to trigger off new, alternative problem solutions. Instead, it seems as if in creative thinking efforts new solutions are derived from the systematic combination and reorganisation of extant knowledge structures (Hausman 1988; Hodder 1988; Mumford and Gustafson 1988; Mumford and Mobley 1989; Rothenberg 1988). This assumption is hardened by further empirical evidence (Rothenberg 1986; Rothenberg and Sobel 1980; Sobel and Rothenberg 1980) and theoretical considerations, supporting the idea that these processes contribute to creativity (Koestler 1964; Kuhn 1970).

Further, Goor and Sommerfeld (1975) investigated differences in the sub-processes by creative and non-creative students using a think-aloud methodology. They observed that highly creative students spent more time on generating new information or hypotheses, working on these hypotheses, and self-reference or self-criticism. Alternatively, Lubart (1994b) examined the role of idea evaluation during the creative process. The results showed that relatively early auto-evaluations of the creative process in progress lead to higher creativity than evaluations executed at later stages. This suggests that the timing of the sub-process of evaluation may have an effect on the outcome's creativity. The importance of this aspect - the process of combination and reorganisation of category information - is especially highlighted as the main difference between creative and standard thought. Accordingly, the variance in the degree of the process outcome's creativity results partially from skill or quantity with which each of the involved sub-processes is executed. However, instead of enumerating further studies on this issue it is more important to summarise that creative and non-creative thinking can be captured with similar or the same models and processes but, nevertheless, differ to the values or parameters within. However, it still remains the task to define what is meant with creative thinking in the present work?

If, as in the present work, it is assumed that general models can be developed accounting for any thinking process, such a model is based on the continuum view. Consequently, the differences, for instance in the degree of creativity, are attributed to different parameter-values of the processes involved in thinking. However, on a sufficiently general level the ones required for creative thinking may not be different from of those needed in non-creative thinking efforts (Bailin 1984; Simonton 1988a, Sternberg 1988a; Weisberg 1988). Supporting this view, Weisberg (1986, 1993) collected introspective reports, laboratory experiments, and case studies of artists and found out that creative productions can be explained by drawing on relatively ordinary cognitive processes. Hence, the main characteristic of creativity is not that it is a somehow divine gift given to a limited number of individuals, but rather the output of ubiquitous cognitive processes. Thus, most generally speaking, the creative process is "[…] the sequence of thoughts and actions that lead to a novel, adaptive production." (Lubart 2001, p. 295) It is important to underline that it is an adaptive phenomenon, because this implies that creativity involves an individual's capacity to generate solutions in response to novel, ill-defined problems (Lumsden and Findlay 1988; Mumford et al. 1997), a stance strongly influenced by the ideas of evolutionary psychology (e.g. Plotkin 2004; Shettleworth 1998). Influential and frequently cited definitions of creativity insinuate that it can be seen as a thinking process that involves problem finding and problem-solving in the narrower sense.

Once again, it should be noticed that such a notion of creativity is different from the one often associated with the concept: Often the terms ‘creative’ or ‘creativity’ are associated with the unexpressed potential for producing such novel outcomes (Hayes 1990). Here, creativity is exactly not seen as a unitary psychological attribute of an individual, but rather as a generic term to capture the complex set of processes involved in the generation of creative outcomes (Crutchfield 1973; Mumford et al. 1991). Its meaning is therefore restricted to creative productivity, i.e. to the actual production or outcome of creative acts, (Ghiselin 1963), such as a scientific discovery, a painting, a new idea for effective social organisation, etc. (Crutchfield 1973). In this sense, creativity could be seen as an activity, which entails tackling problems or generating problem solutions that go beyond extant knowledge (Mumford et al. 1991). For instance, Torrance defined it as “[…] the process of sensing gaps or disturbing missing elements; forming ideas or hypotheses concerning them; testing these hypotheses; and communicating the results, possibly modifying and retesting the hypotheses.” (Torrance 1962, p. 16)

The relation between the terms of problem-solving and the creative act becomes palpable by comparing selected definitions of the terms: For example, Scandura (1977) defines problem-solving as the generation and selection of discretionary actions to bring about a desired end state. Similarly, the creative act could be seen as the formulation of a new idea that proves useful in addressing some social need through generation and implementation of a novel course of action that brought about a valued end-state (Mumford et al. 1991). Both definitions deal with the attainment of a goal or need by certain actions; they mainly differ only in that the definition of a creative act only requires some degree novelty in doing so. Concluding, integrating creative thinking into the notion of problem-solving and adhering to the continuum view on creative thinking, it can be modelled as a situation in which an individual encounters a problematic situation, it finds or constructs a problem, and subsequently attempts to find a solution to this situation or problem, which goes beyond existing knowledge; it is a process of creative problem solving.

Historically, the creative process became a subject of scientific investigation beginning with the mid-19th century, when researcher such as Galton (1870) carried out empirical studies on creative individuals (Subotnik and Moore 1988). Even though a variety of different paths to explain creativity are followed (Dudek and Cote 1994), traditionally two broad psychological explanations for creative thinking have been given: The first places emphasis on rationality, thus leaning on the fundaments of logic; the second approach is called classical associationism and regards thinking as a chain of ideas, or more accurately as a chain of stimulus-response connections (Getzels and Jackson 1962; Wertheimer 1945). These are only two of various further explanations for the creative act, such as those of psychoanalysists (see Getzels and Jacksons 1962) or attempts highlighting different aspects like the need for excitement, sensory variation, or the challenge of the problematic, all unified in assuming that the individual seeks to increase stimulation as well as to decrease it (Piaget 1958, 1959; Schachtel 1959).

Early as 1950, Guilford noticed considerable agreement that the creative act involved four major steps, often named (a) preparation, (b) incubation, (c) illumination, and (d) verification (Guilford 1950). Although, as will be soon discussed, stage models are nowadays seen as insufficient for scientific investigations on creative acts, they are the fundament on which all further efforts to gain insights are more or less based. Therefore, the popular and often cited classical model of Wallas (1926) is presented as an agreed-upon example of various approaches that are quite similar and, therefore, only briefly touched afterwards. Apparently, these process models are of particular interest for the present work since a process view is assumed for opportunity recognition later on. It should become apparent how the scientific notion has evolved during the last decades from models identifying discrete steps, to more complex approaches, considering multiple sub-processes and including contextual aspects, like the one called on in the present work for modelling creative thinking in economic settings in chapter IV.

Research on creativity has started early, and was then - as today and according to the continuum view - closely intertwined with general research on human thought. This notion of the creative thought as a particular case of thought that could be explained within the boundaries of such models had already been underpinned by early studies. These showed that the phases of human thought are equal, whether creativity is involved or not (see e.g. Patrick 1937). In attempts to explain the sequence of thoughts and actions that leads to a novel, adaptive production, basic elements were evoked early in some introspective accounts of the creative act (Lubart 2001). Particularly, famous scientists reported on their way to deal with a problem, for instance Hermann von Helmholtz or Jules Henri Poincaré (Ochse 1990; Lubart 2001). Such introspective reports of creative thoughts were formalised by Wallas (1926), who identified four ideal-type stages of the creative process, already stated by Guilford (1950): preparation, incubation, illumination, and verification (e.g. also mentioned and described as a milestone by Subotnik and Moore 1988).

The phase of (1) preparation refers to preliminary analysis of a problem, which is defined and set up. This is done consciously and draws on an individual’s education, analytical skills, and problem-relevant knowledge. In the course of the following stage, called (2) incubation, no conscious mental work on the problem is done; this may not apply to conscious working on other problems, but can also involve relaxing or taking a break from the problem. Meanwhile, the mind is supposed to work unconsciously on the problem, forming trains of association. It is assumed that many associations or idea combinations occur during incubation. Most of them are - still unconsciously - rejected as useless, but eventually a promising idea is found. The term of (3) illumination is aimed at describing the third stage, or better, to describe the enlightening moment when the idea unconsciously conceived enters the conscious mind, which is sometimes called aha-experience (e.g. Lumpkin et al. 2001). Wallas (1926) was convinced that this moment is often preceded by an intuitive feeling that an idea is coming up; a process he called intimation (Wallas 1926). This phase is believed to be somewhat delicate in the sense that it is easily interrupted by outside interferences or by trying to rush the idea. In the last stage of (4) verification the - now conscious - idea is evaluated, and developed. Although such rather discrete stages were proposed, Wallas himself already admitted that an individual could return to earlier stages in the process, for instance if an idea proves to be failed during the verification phase, forcing the individual to incubate on how to resolve the difficulty. This insight is still important in modelling economic agents' behaviour, for instance considering learning processes in evolutionary economics (Braun 2006). Furthermore, he added that the phases could co-occur if an individual was, for example, engaged in preparation for a particular aspect of the problem at hand and already had an enlightening idea for another aspect of the same problem.

Indeed, some early empirical research on the creative process corroborated the four-stage model: Often cited is a series of studies on poets, visual artists, scientists, and laypersons executed by Patrick (1935, 1937, 1938); however, there were also others (e.g. Hadamard 1945; Rossman 1931). This research revealed that the aspects alleged by Wallas were crucial for understanding creative processes and new models were conceived on this fundament. The results were not concluded from introspections, but verbal protocols recorded while subjects were doing their creative task (Lubart 2001). In addition to verifying Wallas’ model, some overlap between the stages was noted (Calwelti et al. 1992) and found that experts and novices - which were also compared - apply the same basic processes, thus independent of expertise and task domain (Lubart 2001). These research efforts also emphasised the role of the two middle stages - incubation and illumination - serving as base for subsequent research

(Poincare 1952; Gordon 1973; Vinacke 1974; Landau 1978; Rubenzer 1979; Moriarty and Vandenberg 1984). Remarkably, Patrick's methodology is still used to examine the classical four-stage model (see e.g. Moriarty and Vandenbergh 1984; Gustafson and Norlander 1994; Norlander and Gustafson 1998, 1997, 1998), expressing the strong influence of these classical studies on contemporary research in this field.

Yet other authors aimed at modifying the classical model by adding other aspects, thereby triggering off the development towards more recent models of creative thinking. Many efforts intended to elaborate on the elementary steps, in particular the renunciation from the rather mystic and fuzzy notion of illumination by refining the concept is worth being mentioned (Osborn 1953). Further, researchers emphasised the cyclical and the directed, goal-oriented nature of creative thought (Guilford 1967; Kepner and Tregoe 1965; Merrifield et al. 1962): However, already Dewey (1910) reminded that affective or emotional elements must be included in explaining creative thinking. Along these lines, frustration, for example, was assumed to occur after the preparatory stage, because the analytical mind reaches its limits in dealing with the problem (Sapp 1992), some authors even assume that such frustration may provoke incubation (Goleman et al. 1992; Hutchinson 1949). However, starting in the 1960s, scholars' models were more and more applied in organisations in order to improve the creative problem-solving capabilities (Baer 1988; Covington 1987; Kepner and Tregoe 1965 Reese et al. 1976), resulting in new models, such as the Creative Problem-Solving (CPS) approaches, which are dealt with in the next chapter III.C.2. Actually already Guilford (1950) sharply criticised a notion of creative thinking in discrete steps, objecting that: "[s]uch an analysis is very superficial from the psychological point of view. It is more dramatic than it is suggestive of testable hypotheses. It tells us almost nothing about the mental operations that actually occur." (Guilford 1950, p. 451) Rather, he continued, these processes are shaped by certain abilities of creative individuals, including for example sensitivity to problems, a capacity to produce many ideas (called fluency), an ability to recognise, an ability to deal with complexity, and an ability to evaluate (Lubart 2001). The apparent shortcomings of discrete stage models to explain empirical evidence on the creative process had led to even more criticism. For instance, Eindhoven and Vinacke (1952) stated that such models failed to explain their observations on creative processes. Instead they proposed a notion of the creative process as a dynamic blend of processes that co-occur in a recursive way throughout the course of the creative act, paving the way for contemporary process models. Others criticised Patrick's studies, which were supposed to provide evidence for Wallas' model on several points (Bailin 1988; Eindhoven and Vinacke 1952; Vinacke 1952; Weisberg 1986).

Many more attempts could be mentioned to explain the phenomenon. However, it seems more sensible to highlight that motivation to be creative is somewhat different according to the domain it is observed in. Therefore, here it is assumed that motivation for creative thoughts in economic settings is somewhat different from that in art or music, the domains most studies mentioned are based on. Consequently, it will be only focussed on findings found to be relevant to all settings, in particular to the development of general process models of creativity and human thought.

Such general research on creative thinking, analogously to research on cognition, identifies two main elements, which play a crucial role: knowledge and cognitive processes. However, although knowledge seems to be necessary and important to creative problem-solving (Frederiksen 1984; Khandwalla 1993; Sternberg 1986a), it is still open to question, whether knowledge per se provides a fully adequate basis for idea generation and problem-solving; for example, in a novel domain the value of high-specialised domain-specific expertise is not quite clear (Anderson 2001; Gentner and Block 1983). This insufficiency of knowledge to account for creative problem-solving outcomes has led to an emphasis on the role of cognitive processes and a focus on so called process-analytic approaches (Mumford et al. 1991).

This shall not suggest that these were the only perspectives chosen for doing research on the topic, but attempts to identify individual temperamental or personality characteristics (MacKinnon 1962) or research on tolerance for ambiguity, openness to experience, and cognitive complexity influencing the willingness to seek out and apply multiple categories (McCrae 1987) were not sufficiently successful in explaining novel output of thinking. Therefore, hereafter a general overview on research that modelled creativity as a thinking process will be presented by making a general distinction: Firstly, the historic development of classic process models will be briefly described; secondly, characteristics of the processes and skills embraced in contemporary accounts of creative thinking are reviewed and, thereby, problem finding as account of creativity is introduced separately because it resembles to the notion of cognitive creativity alleged in the model of human action in time.

Generally speaking, nowadays researchers tend to reject superficial stage-based descriptions (Goldschmidt 1991; Doyle 1998; Israeli 1962, 1981). All this criticism on the classical notion of discrete stage-models and new approaches can be seen in a general research movement - starting the latest with Guilford (1950) - focussing on key processes involved in creative thinking (Lubart 2001). It had been realised that discrete stages are an inadequate construct to explain creative processes, for instance admitting that "[i]t is not incubation itself that we find of great interest. It is the nature of the processes that occur during the latent period of incubation, as well as before it and after it." (Guilford 1950, p.451) In turn, scholars were claiming for an integrative approach (Lubart 2001) particularly stressing several features and sub-processes of the creative process.

2. Cognitive Processes in Creative Thinking

The re-orientation of cognitive psychology on more fine-grained process involved in creative thinking must be seen in the general context of research development. Basically, process-analytic models were introduced in order to investigate thinking processes and, in doing so, emphasising the role of knowledge in process application (Mumford et al. 1991). Along these lines, a large number of studies on the nature of sub-processes involved in creativity have been carried out, each focussing on one aspect of the phenomenon, being crucial to creative problem-solving (Lubart 1994a; Ochse 1990; Sternberg 1999; Sternberg and Lubart 1995). Just to mention some important streams, there were scholars focussing on problem finding, problem formulation, and problem redefinition processes (Getzels and Csikszentmihalyi 1976; Jay and Perkins 1997; Mumford et al. 1996b; Reiter-Palmon et al. 1997; Runco 1994; Smilansky 1984); studies on processes of synthesis or combination of information, such as bisociation (Koestler 1964), Janusian thinking (Rothenberg 1979, 1996), homospatial thinking (Rothenberg 1979, 1986), articulation (Rothenberg 1979), analogy and metaphor (Ward et al. 1997; Weisberg 1993), remote association (Mednick 1962), emotional resonance (Lubart and Getz 1997), and feature mapping (Baughman and Mumford 1995; Boden 1992; Mumford et al. 1997). Further, studies were done on forming idea combinations through random or chance-based processes (Campbell 1960; Simonton 1988b) or on reorganising information as a part of creative thinking, with special attention to processes involved in insight (Baughman and Mumford 1995; Sternberg and Davidson 1995). Again others intended to explain the role of analytic-evaluative processes (Basadur 1995; Houtz et al. 1979; Lubart 1994b; Mumford et al. 1996c; Osborn 1958; Perking 1983), of perception and information-encoding (Mumford et al. 1996a; Smith and Carlson 1990), and applying heuristics (Langley et al. 1987); even the process of forgetting was targeted since it might be of significance in the individual's approach to a problem and the overcoming of initial mental blocks (Smith and Dodds 1999).

Since the capacity to generate new associational linkages has been regarded as the most important in producing creative problem solutions (Mumford et al. 1991) and is often mentioned in the context of opportunity recognition (see chapter IV.C.3), the basic idea of approaches emphasising associational process in creative thinking is mentioned in some detail. It is typical for such models that creative solutions to a problem are attributed to useful new element linkages of extant knowledge as result of associational thinking efforts. Typically, these new linkages are assumed to emphasise stimulus activation, association of activated elements, and subsequent trial-and-error evaluation (Mumford et al. 1991). The approaches within the stream range from concepts for remote association (Mednick and Mednick 1967) to more recent accounts of node linkages in knowledge structures (see e.g. Lumsden and Findlay 1988; Simonton 1988). For example, Mednick (1962) introduced the terms of bisociation and association in order to distinguish between different modes of thinking. Although terminologically perhaps confusing, bisociation denotes the process in which two knowledge concepts interact; they become bisociated. This means in other words that previously unconnected matrices of experience are connected (Koestler 1964). It is seen as the actual creative act since it creates novelty based on interrelated knowledge structures brought into contact (Ko 2004). This means that an individual with a high bisociative thinking ability is likely to produce novel and original ideas. In comparison, association or associative thinking refers in this concept to rather non-creative thinking that operates among members of one single pre-existing knowledge structure.

Although such approaches offer a potential for utility (Langley and Jones 1988) it has turned out that they are incapable of accounting for several observable phenomena in creative problem-solving and, therefore, appear inappropriate as a general framework (Mumford and Mobley 1989). Among the aspects of creative problem-solving discrediting it as a general framework, were the active, effortful nature of creative thinking (Howe 1982), the internal direction that occurs in creative problem-solving (Getzels and Csikszentmihalyi 1976), the restrictions on prior categorisation places on possible linkages (Perkins 1983), and the apparent importance of discrepancies (Kuhn 1970). Evidently, this does not imply that associational mechanisms, if combined with the selection, generation, and application of decision rules for applying the new linkages, may not be crucial in certain, rather divergent core processes, such as problem construction and category combination and reorganisation (Redmond 1990; Reiter-Palmon 1990). Instead, associational linkages are here seen on a lower analytical level, working together with other processes, not being the one and only crucial process in producing novel outcomes. In this way, most of the studies mentioned above have not been criticised for the predictive value of their results or the processes observed, but rather for their insufficiency to explain the phenomena of creative thinking as a whole. Therefore, models were desired that organise the sub-processes involved in the creative thought, thus proposing an integrated view, not simply focussing on one aspect of the creative thought, but rather on general, cross-domain factors contributing to the generation of new problem solutions (Covington 1987).

Once again, it is neither feasible nor desirable to introduce all recent process models that have been developed in a general effort to account for creative thinking. Only the most influential approaches most frequently referred to in the literature are touched here: For instance, Mumford et al. (1991) developed an approach that proposes, generally speaking, a specified set of core processes for creativity that is assumed to operate on information organised in categorical structures. It is a dynamic model, which allows for cycling between different processes as considered necessary during all problem-solving efforts. Each of the core processes is itself complex and involves more specific sub-processes. Particular emphasis is put on the process of problem construction. The model was examined in a series of studies, which suggest that it is capable of explaining variance in creative performance on problem-solving tasks regarding the domains of advertising, management, or public policy issues (e.g. Baughman and Mumford 1995; Mobley et al. 1994; Mumford et al. 1991, 1996a, 1997). This model and its basic conjectures will be used in the subsequent study and therefore introduced in more detail in chapter IV.B.

Another influential approach is the Geneplore Model conceived by Finke et al. (1992), distinguishing between two sets of creative processes, which are named generative and exploratory processes. Generative processes concern the construction of loosely formulated ideas that are called pre-inventive structures. This comprises the processes of knowledge retrieval, idea association, synthesis, transformation, and analogical transfer. The exploratory processes concern the examination, elaboration, and testing of the pre-inventive structures, involving interpretation of pre-inventive structures, hypotheses testing, and searching for limitations. These two sets of processes are highly intertwined and therefore modelled in cyclical sequences, finally leading to creative products. Along these lines, Phillipson (2002) introduced an information processing model of creativity resembling the Geneplore model in that it also emphasises the role of associative processes in creativity. In a sense, these research efforts were all based on the notion that creativity can be mainly regarded as the process of "[…] sensing difficulties, problems, gaps of information, missing elements something askew […]." (Torrance 1988, p. 47; see also Koestler 1964)

Alternatively, the approach of Creative Problem-solving (CPS) is quite often mentioned as a general framework for modelling creative thinking. Initially, this approach had a stage-based view but has been revised reflecting more emphasis on sub-processes (Isaksen and Treffinger 1985; Parnes 1967). Now, instead of a fixed series of stages, three sets of processes are assumed to be most important in the creative act: (1) understanding the problem, which refers to processes of mess finding, data finding, and problem finding, (2) generalising ideas, that is idea finding through divergent thinking, elaboration of ideas, and convergent thinking with evaluation of ideas, and, finally, (3) planning for action, involving the development and implementation of ideas through solution finding (evaluating, selecting, and refining options) and acceptance finding (promoting an idea, selling support, noting resistance). Further to this, several idea-evaluation approaches have been brought up as variation of the creative process in terms of idea generation and idea evaluation (Hitt 1965; Basadur 1995).

For example, Basadur (1995) has developed a creative problem-solving process in terms of such ideation-evaluation cycles, which vary in their frequency according to the nature of the problem to be solved and the phase in the process of problem-solving. Runco and Chand (1995) emphasised the role of ideation and evaluation together with problem finding in the creative process. Basically, these approaches resemble to the psychodynamic approach to creativity, in which primary and secondary approaches are supposed to interact (Kris 1952; Kubie 1958; Suler 1980). The primary process operates on unstructured, illogical, subjective thoughts and produces ideational material. This serves as ‘raw material’ for the subsequent reality-based, controlled, evaluative secondary process. Again other authors proposed an evolutionary perspective on the creative process: They presumed a process of idea formation, shaped by random variations and combinations, preceding a process of evaluations leading to selective retention of the best ideas (Campbell 1960; Simonton 1988c).

All the above mentioned models have in common that they focus on the cognitive aspect solely. However, contextual variables are undoubtedly crucial to explain the phenomenon as well. Precisely this is argued by so called facet models, approaches that emphasise the influence on cognitive process application’s efficiency by a host of factors such as personality, conditioning available information, skill utilisation, and problem definition (Mumford and Gustafson 1988). Thus, they could be seen as more comprehensive approaches trying to include several perspectives on the psychological phenomenon at hand. In a way, they are quite similar to cognitive models but typically emphasise the selective nature of process application in relation to real-world constraints, along with the existence of multiple, complex interactions between these processes and other features of the individual's life (Amabile 1983; Busse and Mansfield 1980; Sternberg 1986a 1986b 1988a 1989).

For instance, Busse and Mansfield (1980) added a motivational or attentional component to the cognitive processes since the latter are executed in a dynamic, selective manner bound by real-world constraints. Then again, Amabile (1983) hypothesised that the generation of creative solutions to problems is likely to be conditioned by three categories of variables that mould active cognitive processes: (1) the domain-relevant skills, or the response possibilities, factual knowledge, and technical skills available to the individual at hand; (2) creativity-relevant skills, including cognitive style, working style, and heuristic cognitive processes; and (3) task motivation. Finally, the Three-Facet Model of Creativity was conceived by Sternberg (1988a) and is composed of personality, stylistic, and intellectual constructs (see also Sternberg 1986a, 1986b). The facets are held to dynamically interact to condition the nature and the content of creative problem solutions. However, the intellectual function is assumed to guide the processing of an individual in a metacognitive manner.

In conclusion, it can be stated that all general approaches (classical models, process models, and facet models), despite of different terminology, share an eminent base in their notions of the creative process. Most generally speaking, they all assume a rather exploratory phase, which ends with a problem to solve or a situation to change; followed by a phase which is dedicated to the more concrete solution within the restrictions found. The approaches mainly differ in sub-processes and contextual aspects considered. Although some approaches are basically different from others, it must be kept in mind that they are only different constructs of researchers to explain the same phenomenon (Keating and Babbitt 1978; Keating et al. 1985; Lansman et al. 1982). It turns out that the research stream that intends to account for creativity in thinking through problem finding is no exception in this context. However, due to the importance of the problem-solving notion of thinking in contemporary research it is outlined in some detail in the following.

In the 1950s and 1960s, a lot of publications in this area have succeeded in turning the investigation of creativity back to the concept of divergent thinking (for example Bachelor and Michael 1991; Guilford 1967; Khandwalla 1993; Merrifield et al. 1962; Runco 1991). In this concept it is assumed that successful creative activity can only be achieved, if the components of divergent thinking (consisting of fluency, flexibility, originality, and elaboration) and convergent thinking cooperate. However, while both components are partly innate and partly developed, particular emphasis is put on the role of personality (Dudek and

Cote 1994). The construct of divergent thinking was introduced by Guilford (1950) as a trait approach, which means in this context defining creativity in terms of individual differences on some set of tasks (Fleishman and Quaintance 1984). Its basic idea is that "[…] certain trade-offs at the margin ought to increase the probability of hitting on a creative, that is, synthesised, and therefore possibly original solution: redefinition or restructuring the problem (or some elements of the problem) rather than merely analysing it, listing potential leads rather than merely scanning memory for solutions, elaborating on ideas rather than merely evaluating them, and expressing frustration rather than repressing it." (Khandwalla 1993, p. 36) Many problems were associated with the notion of divergent thinking, for instance the fact that many skills developed by adult individuals, such as expertise or eminence, cannot be covered (Nicholls 1972). Nevertheless, the basic idea of locating creativity in the stages dedicated to find a problem, as expressed in Khandwalla's statement, is still quite popular with many researchers. Somehow, these approaches are building on the classical models of creativity that still serve as the fundament for understanding the creative process (Busse and Mansfield 1980; Cagle 1985; Goswami 1996; Ochse 1990; Osborn 1953; Stein 1974; Taylor 1959; Taylor et al. 1974). Based on these discrete stage models, efforts were made to explain creative acts of individuals from a problem-solving-perspective.

The main idea behind an problem solving account (in the broader sense) of creative thinking was that the manner in which we represent a problem state has crucial influences on the whole thinking process, consequently also on the creativity of the outcome (Anderson 2001). Thus, the underlying notion of creative thinking as a particular thought process allows a framing of the process in problem-solving terms. Based on such a notion of a creative problem-solving process, Wallas' four-stage model has been extended and enhanced by distinguishing problem finding or problem-formulation from the preparatory phase, in which relevant information is gathered, and preliminary ideas are advanced (Lubart 2001): It is assumed that the factors influencing creative outputs can be mainly found in the phase of problem finding. Basically, this phase is similar to all the explanatory phases in the models presented in the previous chapter. This is particularly worth being mentioned since it is similar to the idea of creativity in the model of human action introduced in chapter II.B.2: The inherent creativity of human thinking can be found in the processes of representing a problem, the cognitive creation of a mental situation.

However, research attempts highlighting problem finding's importance for creative acts, often quote famous scientists, who have pointed to the significance of asking questions in thinking efforts. For instance, Paul Souriau has stated: “It is said that a question well posed is half-answered. If so, the true invention consists in the posing of questions. There is something mechanical, so to speak, in the art of finding solution. The truly original mind is that which discovers problems.” (Paul Souriau (1881) cited in Campbell 1960) Several famous people have made similar statements for the field of science. For example Albert Einstein was convinced that “[T]he formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, a new problem, to regard old problems from a new angle, requires creative imagination and marks real advance in science.” (Einstein and Infeld 1938, p. 92) Similarly, Max Wertheimer said: “The function of thinking is not just solving an actual problem but discovering, envisaging, going into deeper questions. Often in great discovery the most important thing is that a certain question is found. Envisaging, putting the productive question is often more important than the solution of a set question.” (Wertheimer 1945, p. 123)

In a general context, it has already been said the problem finding and problem-solving cannot be distinguished explicitly; this holds particularly true for creative thinking processes. Getzels and Csikszentmihalyi (1976) point out that in a creative process the stages of problem finding and problem-solving do not even need to be compartmentalised. Quite the contrary, problem finding continues throughout the whole creative process (Getzels and Csikszentmihalyi 1976; Michael 1977). In fact, research has not yet fully revealed the underlying structures of these thinking processes. Having said that, the application of divergent thinking in problem-solving implies that even in presented problem situations, creative skills might be necessary. This suggests that in dealing with creative thinking, it is crucial to carefully describe the processes that initiate problem-solving: It must be clearly defined what processes or skills is talked about, rather than simply referring to problem finding as anything that precedes problem-solving efforts.

In more fine-grained attempts, some scholars intended to identify the processes involved in problem finding, and the way they are linked together, conceiving process models. Based on Mackworth (1965) and Guilford’s (1967) structure of the intellect model, Arlin (1976) investigated problem finding, trying to identify cognitive processes in the course of problem finding. The basic conjecture underlying her model is that a successful individual consistently employs a complex schema in the organisation of several dimensions. Such individuals combine a number of strategies and rules in information processing, are fluent in their thinking and expression, are flexible and able to elaborate on the given, are divergent thinkers, and are effectively using formal operations. Based on this notion a cognitive process model of problem finding is conceived, which leads to the output or outcome of a so called general question, the tentative or preliminary problem definition.

The main line of processing in Arlin's model is built up by four main operations and starts with external stimuli that initiate the problem finding process. Then, the individual discriminates among the stimuli perceived. The discriminated stimuli are subsequently differentiated that means they are ordered along a number of dimensions. If the individual does not only identify the classes the processed information belong to and instead integrates them, the appropriate formal operator(s) are selected to be applied to the integrated pattern of information. Furthermore, systems are identified that emerge from the application of the relevant operator(s). This is the end of the process, if the individual does not transform the pattern or generates logical implications from it. Finally, this leads to the mentioned output of a general question. The main cognitive variables that were together capable of explaining half of the variance in problem finding performance in this study are fluency and flexibility in discriminating and differentiating stimuli, as well as elaboration, which leads from the integration to selection, respectively application, of the formal operator(s) (Arlin 1976). Here, fluency refers to the ability of making interesting associations, and flexibility to the ability to rearrange the stimuli across a number of dimensions. Actually, these variables were already suggested to be crucial in previous studies on creativity (see e.g. Guilford 1956, 1959, 1967, 1971; Torrance 1962, 1964; Wallach and Wing 1969) and on problem finding (Getzels and Csikszentmihalyi 1965, 1970, 1971).

Others, for instance Michael (1977), studied the relationship between Guilford's structure of the intellect model and various steps of creative problem-solving. Nevertheless, the study already assumes that classical discrete models are too linear to describe the continuous feedback loops within each step of the creative process. As already insinuated in discussing different types of problems, Dillon (1985) investigated problem finding and solving by varying the degree of complexity of the problem finding task. That is some tasks only involved noticing problems arranged and manipulated by the experimenter, while others forced the subject to discover discrepancies or contradictions independently within given data or materials. The most complex tasks consisted in seeking provocative problems without any predetermined boundaries given by the experimenter. The study was aimed at revealing the relationships between different kinds of problem finding (according to the level of complexity and independence) and the related problem-solving efforts. Dillon found out that the relationships grew weaker as the level of complexity and independence increased. Correspondingly, he suggested that individuals could be differentiated on the basis of their preference for problem finding rather than problem solving, and more precisely, on the basis of their preference for particular levels of problem finding and solving (Dillon 1985).

By taking a closer look at the phenomena, empirical studies substantiated the argument that problem finding as a construct can contribute to gain insights on the creative act. The first systematic research on problem finding coming to such results was done by Getzels and Csikszentmihalyi (1976). They aimed at shedding light on the role that problem finding and the underlying cognitive processes play in creative processes. More specifically, they wanted to find the degree to which problem finding activity was associated with quality of the final product (Dudek and Cote 1994). Their studies and subsequent experiments confirmed the positive correlation between discovery-oriented behaviours and the originality of the artwork (e.g. Csikszenmihalyi 1990). For instance, studies were executed finding a positive correlation between problem finding scores and several indicators of creative potential (Wakefield 1985). Other studies indicated that an individual finds more original solutions to a problem discovered on its own than for a problem that is presented to him (Runco and Okuda 1988). Yet other research suggested that measures of an individual's problem finding skills have predictive power for its creative achievement (Getzels and Smilansky 1983; Hoover and Feldhusen 1990; Redmond et al. 1993; Smilansky 1984); mostly even higher than that of verbal reasoning and divergent thinking tests (Mumford et al. 1996b). Methodologically, very often the time spent on information manipulation before solving a problem is measured. Another popular method is to investigate the number of explored problem elements before the proposition of an initial idea; or simply question-asking behaviours of subjects in experimental situations (see e.g. Getzels and Csikszentmihalyi 1976; Glover 1979; Jay and Perkins 1997; Kay 1991; Rostan 1994).

In summary, the previous considerations contained different cognitive approaches to model human thought and creative thought, and outlined their connection with each other. However, it should be kept in mind that cognition and information processing are only a particular view on the phenomenon of creative human thinking, focussing on cognitive processes and the knowledge it is operated on. It can be thought of a mass of variables that influence the nature and ontogeny of the creative act (Mumford and Gustafson 1988). Therefore, concluding this foundational chapter, a classification of contextual variables influencing the cognitive processes is introduced, mainly placed in the interplay of personal motivation and sociocultural factors (Sternberg and Lubart 1999). This is an important aspect for the argumentation of the present work since it is assumed that cognitive patterns a relatively stable and stored as schemas guiding an individual's information processing.

3. Creativity, Context, and Cognitive Styles

Most generally, and according to the general approach here, two categories of variables can be differentiated that interact with cognitive processes in creative thinking: Individual (personal) and situational (contextual) variables (Crutchfield 1973). While aspects such as knowledge, basic cognitive processes, aptitudes and abilities, personality characteristics, and environmental perceptions would be attached to personal variables, environmental structure, cultural characteristics, and economic or evaluative considerations would be assigned to the latter category. Hereafter, various personal and contextual factors are briefly presented and it is outlined, how they are assumed to influence an individual's processing efforts in creative thinking. Considering the enormous variety of factors that could be mentioned for general thought processes, the following chapter will focus on the creative thought.

However, theoretic explanations to systematise individual or contextual differences of creativity are rather seldom, and those existing all draw a rather similar picture that will be briefly sketched here (Lubart 2001): In creativity literature most authors identify five aggregates of influencing variables, conditioning the creative outcome of any thinking process (Mumford et al. 1991; Mumford and Gustafson 1988). While the first set is the one which is mainly dealt with in this work and has been presented in some detail - the (a) cognitive processes contributing to the individual's capacity of generating novel problem solutions – being rather a part of an individual's personality, the second set is derived form the (b) situation persons are situated in (Mumford et al. 1991). The inclusion of situative elements augments the perspective on the phenomenon from a micro-approach, dissecting cognition from other aspects, to a rather embedded view as in approaches of situated cognition (Salthouse and Craik 2000). Nevertheless, it should be kept in mind that methodological individualism requires to cast contextual or situational aspects from the perspective of the individual.

As to the (a) personal variables shaping information processing, Amabile (1996) emphasised individual differences for the level of creative productions; in particular task motivation, domain-relevant knowledge and skills, as well as the application of creativity-relevant processes are mentioned. The corresponding empirical results suggest that these model variables could account for differences in creative, rather than in analytical algebraic tasks. However, before focussing on a general framework for personal variables influencing creative thinking, it should be kept in mind that there exist strong relationships between such abilities or personal variables and cognitive processes, justifying to start with the individual in assessing creative thinking (Jensen 1987; Keating and Babbitt 1978; Lansman et al. 1982). At this point, it could be reasoned that both approaches are only different constructs of researchers to understand an observable phenomenon: This view implies that cognitive processes represent component operations underlying more basic abilities. Consequently, it might be argued that processing skills do not contribute to superior measurement of creative thinking (Mumford et al. 1997a).

However, contradictory findings indicating an unique contribution of certain cognitive processes to the solution of creative problems (e.g. Mumford et. 1996a; Mumford et al. 1996b; Okuda et al. 1990; Smilansky 1984), suggest that processing capacities represent procedures or general strategies on their own, which are also subject to certain developmental influences (Finke et al. 1992). Consequently, Hoover (1990) developed a more general theoretical framework of aggregated components that influence the creative thought of any individual, based upon a review of both, the general psychological and gifted education, literatures on problem finding and -solving. The four components presented were (1) memory organisation and facilitation, (2) specific and general problem-solving skills, (3) metacognitive skills, and (4) extra-cognitive or cognitive style attributes and are depicted in Figure 27 with their corresponding subcategories.

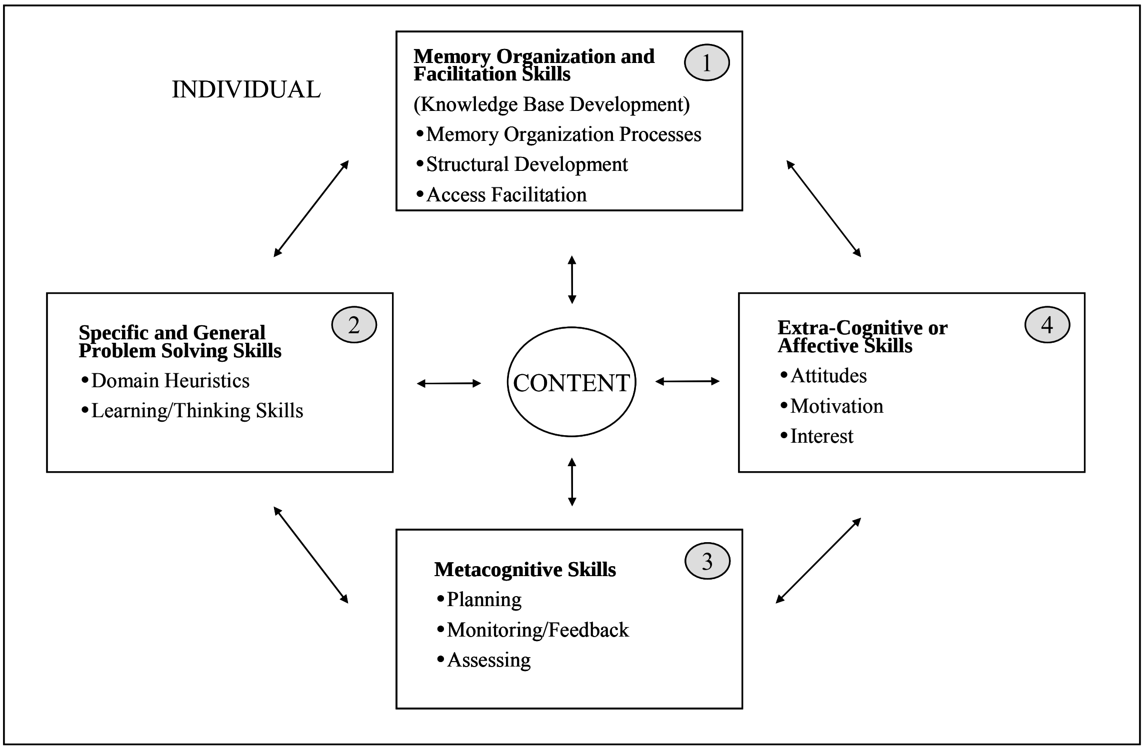

Figure 27 Components of Problem-Finding and Problem-Solving (Hoover and Feldhusen 1994).

Many insights on individual problem-solving capabilities, which could be tagged as the way an individual processes information and are summarised hereafter, were derived from comparisons of the differences between experts and novices, observing what makes up good or effective, respectively creative problem solvers from poor performers (Hoover and Feldhusen 1994; Mumford et al. 1991). The first component, memory organisation and facilitation, refers to the context of a specified domain or knowledge base, while the aspect of specific and general skills or heuristics involves the acquisition of knowledge or information to be integrated within the existing knowledge base. The term of metacognitive or executive strategies embraces such processing strategies that direct, control, monitor, and evaluate the processes of information. Further, the extra-cognitive functions provide interest and motivation in the problem, and establish an orientation on the part of the individual towards the discovery and elucidation of significant problems. It is important to notice that these components are interacting, which is crucial in elucidating gaps in the knowledge base that are of significance. For instance, metacognitive strategies provide the necessary monitoring functions during the whole process, thus play a role for all aspects. Thus, the aggregation is apparently more of a theoretical nature and the components, respectively aspects within, are strongly interrelated. Nevertheless, each of the components represents a dimension, to which individuals differ providing a basis for distinguishing them, which is briefly done in the following.

Concerning (1) memory organisation and facilitation it can be argued that in any real thinking process an individual interacts with the content or knowledge within a domain, strategies are employed to organise information and allow for effective access as problems are encountered. In finding a problem, for example, a superior individual disposes of an effective knowledge base and, therefore, is capable of recognising when new information does not fit into the existing cognitive structures (Hoover and Feldhusen 1994). In any given situation, individuals exhibit differences as to this absorptive capacity; it seems that effective problem-solvers' memory organisation and facilitation differ qualitatively and quantitatively from that of less effective individuals. Quantitatively, their memory contains more specific procedural knowledge for solving particular types of problems and, additionally, more specific information about particular problem domains. Furthermore, they tend to access information through a scheme that contains both information about a class of problems as well as procedures useful in solving them (Chi et al. 1981; Sweller et al. 1983). Qualitatively, good problem solvers tend to organise information about the basic or underlying principles of a domain (Chi et al. 1981; Sweller et al. 1983; Gick and Holoyak 1983). This organisation is made in a hierarchical set with superordinate categories based on abstract concepts and subordinate categories on more concrete representations (Chi and Koeske 1983). As a result or implication of this superior access to appropriate procedural and declarative knowledge-based schemas, superior problem solvers reduce their short-term memory load and make additional processing capacity available (Hoover and Feldhusen 1994; Sternberg 1985). This additional processing capacity allows such individuals going beyond simple acquisition of information and instead accessing their extant knowledge base.

Additionally, it seems as if good problem solvers posses a strong general base of knowledge to a particular class of problem (Chase and Simon 1973; de Groot 1965; Mulholland et al. 1980; Holzman et al. 1983; Chi et al.1981; Larkin and Reif 1979; Smith and Good 1984). Very often such knowledge is acquired through many years of intense involvement in a domain or field of study by which specific and general problem-solving skills are developed (Greeno 1978); i.e. experienced problem solvers have accumulated knowledge about a specific domain that is indeed coupled with an appropriate organisation of the knowledge in memory. This particularly enables them to construct useful problem representations (Larkin and Reif 1979). In this regard it seems sensible differentiating clearly between experience and expertise (Neale and Northcraft 1990). While experience is only seen as simple feedback, expertise means that the individual has a conceptual understanding of how a rational decision processes looks like and is aware of the biases that limit the rationality of such decisions in general and in its own case (Ucbasaran 2004).

However, before new or novel information enters the cognitive system, it is first dealt with by (2) specific, domain-relevant problem-solving skills. If the individual fails to adequately integrate either new information or results of the operations performed by its specific skills on new information, more general problem-solving skills are employed, which are far less directly tied to a specific content domain. Thus, in this particular view, problem finding could be regarded as result from an effort of the individual to utilise both specific and general problem-solving procedures as an attempt is made to integrate new data, experiences, or information into an organised memory structure. Put differently, superior problem-solvers simply seem to know what is useful and effective in a specific problem domain (Hoover and Feldhusen 1994). These procedures are often called heuristics; generally, this term refers to "[…] simplifying strategies that individuals use to make strategic use […], especially in complex situations where less complete information is available." (Ucbasaran 2004, p. 79)

However, it should be kept in mind that several studies underpin the assumption that a point of decreasing creativity exists, as an individual disposes of exuberant knowledge; the reasons are seen in an automated and unchecked, rather automated responding to problems (Hoover and Feldhusen 1994). In fact, this might lead to a tunnel vision and stereotyped problem-solving efforts (Basadur 1994). If an individual's creativity is therefore really endangered by putting too much faith in past experience (Runco 1994), there must consequently exist an optimal level of expertise in order to maximise creativity (Rubenson and Runco 1991). Therefore, it seems necessary to retain flexibility and sensitivity in creative problem-solving tasks. Even in other task environments a strategy might be effective in a particular domain or situation, but turns out to be ineffective in another. Generally speaking, the only strategies that will allow continued creativity are those open to modification. In conclusion, the importance of strategies is often exaggerated since they do not guarantee creative success. Strategy reflects know-how or procedural knowledge, but in fact also know-what or declarative knowledge are crucial and dependent on the individual's cognition, e.g. its attention or perception (Hoover and Feldhusen 1994).

Further to this, humans are able to step back from the situation at hand and to reflect about the information processes applied. These capabilities are named (3) metacognitive or processing skills, which refer to higher order thinking that involves an individual's active control over the cognitive processes (Livingston 1997). For instance, within a class of similar problems, good problem solvers spend more time on solving the initial tasks of representation (and of conceptualisation) of the problem domain. Conversely, less time is spent on later stages of the solution. A main reason for this could be that such individuals have a higher awareness of time needed for planning and understanding of a problem (Greeno 1978; Mulholland et al. 1980). In other words, such individuals reflect on the cognitive processes, for instance heuristics, they apply in a given situation. Furthermore, good problem solvers show an increase in processing speed and an automatisation of processing (Sternberg 1985). This enables them to shift available processing capacity to more effective process strategies (in order to overcome limitations in short-term memory), and to monitor their own progress and spend more time on such self-checking, respectively execute a more effective and continuous monitoring (Mulholland et al. 1980; Smith and Good 1984). Summarising the last argument, it can be said that whatever term is used in this context, they all emphasise the role of executive processes in the overseeing and regulation of cognitive processes (Livingston 1997).

In addition to these aspects, which can be rather easily integrated in an information processing account of human thinking, (4) extra-cognitive or affective psychological factors apparently influence the information processing in an individual's problem-solving effort as well, but cannot be directly related to cognitive process. Frequently, the role of rather rational cognitive aspects in thinking is overemphasised: "Cognition is too often defined as distinct from affect, attitude, and even metacognition. Definitions emphasising cognition may be used as conveniences, but clearly they are as unrealistic […]. Thinking is not entirely rational. Emotions direct lines of thought and are responsible for the motivation and effort needed to process information." (Runco 1994, p. 278) So far, research on creative thinking has not thoroughly explored this component in comparison to other aspects, in particular little has been done within the information processing paradigm (Gardner 1988; Hoover and Feldhusen 1994). One of only few exceptions is the study of Dudek and Cote (1994) who found out that the originality of an art product is highly correlated with an individual's motivation or emotional involvement.[xxii]

However, the decisive point in an information processing account of creative thinking is not merely emotional involvement, but rather the transformation of involvement into symbolic meaning relevant to cognitive processing (Dudek and Cote 1994). Components that equally belong in this category - critical to deal with from an information processing perspective - are extra-cognitive aspects such as tolerance for ambiguity, field dependence or independence, reflectivity or impulsivity, or interest and motivation; i.e. an individual's level of perseverance or intrinsic motivation (Lubart 2001). Aspects such as feeling (Dudek and Cote 1994), purpose (Kay 1994), complacency (Moore 1994), interest (Houtz 1994), anxiety (Smith and Carlsson 1983; Smith et al. 1990) or empathy (Wakefield 1995) are of crucial influence for information processing. To put it simple: If there is no interest, there is no problem (Runco 1994).[xxiii] Therefore, scholars have recently spent more time on investigating interactions between cognition and affect (Lazarus 1991; Runco 1994b; Zajonc 1980; see for a general overview Phelps 2005). Indeed, affect might be of increased interest particularly if the notion of the present work is accepted that problems are not inherent in the situation but rather constructed by individuals (Runco 1994).

In this context, the term of cognitive style is frequently used; basically, it is the way in which individuals think and order their environments, order their sensory preferences, and formulate and communicate their ideas; i.e. it refers to an individual's typical way of processing information (Martinsen and Kaufmann 2000). The issue seems particularly interesting to the present work since many scholars are convinced that such individual differences are most important in novel and ill-defined situations (Fritz et al. 2002). However, the concept of cognitive style is not a pure cognitive concept since affective aspects such as interest and attitudes do play an important role, thus being a linking element between cognition and personality (Fritz et al. 2002): It is a person's rather stable, characteristic style of acquiring and using information and, therefore, used as an expression of psychological differentiation within characteristic modes of information processing. This assertion transforms an adult's cognitive style into a highly automatic and consistent as well as integrated and intricate behavioural mode that is quite consistent across task situations (Fritz et al. 2002; Witkin and Goodenough 1981). Regarding stability, the present work assumes that the term of cognitive preferences refers to less robust ways of information processing, which are more malleable than and not as rigid in time as cognitive styles are.

As said, this rigidity that characterises cognitive styles somehow transforms them into distinguishing features of an individual's personal nature. Given this statement, cognitive styles might be considered as personality traits. However, in using this term caution is advised since trait theory in psychology deals with quite heterogeneous concepts: While all traits share some common features the term embraces as well easily changeable as broad and possibly genetically based characteristics of human personality. It is asserted here that a cognitive style is not a genetically inherited feature of an organism, i.e. no phenotype. Rather, cognitive styles are developed in early childhood highly shaped by family environments (Witkin and Goodenough 1981). This developmental characteristic implies that an individual exhibits a certain degree of consistency in processing information (Cornet 1983; Claxton and Ralston 1978), but by no means that it cannot be changed and influenced by appropriate learning measures. Since, it is a distinctive characteristic of trait theory to neglect such developmental aspects and individual behaviour in specific situations (Heffner 2002), traits are here considered as being different from cognitive style. The former terms is here understood as referring to far more rigid patterns of behaviour, resting deeper in a person's personality.

However, several theories of cognitive style haven been developed, intending to categorise such according to one ore more dimensions. Quite prominent among these is field-dependence cognitive style theory distinguishing between field-dependent and field-independent styles. Individuals exhibiting the former cognitive style are assumed to have interest in social contacts and other people as well as good interpersonal and communication skills. In turn, field-independent cognitive style includes individual and analytic interests and problem-solving skills (Witkin and Goodenough 1981). However, various cognitive styles have been identified, measured, and shown to affect the manner in which individuals perceive their environments distinguishing individuals as to one ore more aspects of their information processing behaviour. In addition to field dependence or field independence, individuals' styles are assumed to differ concerning type of scanning, breadth of categorisation, way of conceptualising, cognitive complexity or simplicity, degree of reflectiveness or impulsivity, degree of levelling or sharpening, flexibility of control, as well as tolerance for incongruous or unrealistic experiences, just to mention a few (Hoover and Feldhusen 1994).

Cognitive Styles...

- ...are an individual's way of thinking and ordering its environments, ordering its sensory preferences, and formulating and communicating its ideas.
- ...are highly automatic as well as integrated and intricate behavioural modes.
- …are temporally robust.
- …are quite consistent across task situations.
- ...a way of psychologically differentiating individuals.
- ...unfold their strongest impact in novel and ill-defined situations.

Figure 28 Central Characteristics of Cognitive Styles.

Summarizing what has been said, Figure 28 lists the central characteristics of cognitive styles. In fact, many terms and concepts have been introduced to distinguish individuals as to one ore more of these aspects of their information processing behaviour. Basically, it is dealt with an individual's strategy, a term that refers here "[...] to a pattern of decisions in the acquisition, retention, and utilisation of information that serves to meet certain objectives, i.e., to ensure certain forms of outcome and to insure against certain others." (Bruner et al. 1956, p. 54)

Another, similar but rather cognitive concept of explaining such typical person-bound information processing emphasises other aspects and explicitly refers to the conjecture that such ways of information processing are stored in human memory as knowledge structures and guide current processing efforts. It has been deal with the concept of schemas; however, here it is important to state that there exist so called habitual or chronic schemas that are habitually activated by an individual in response to a specific stimulus. Thereby, the individual skips the assessment of appropriateness to the situation at hand and reacts rather meachanistic (Gaglio and Katz 2001).[xxiv] These schemas can be consciously activated and used by an individual, but their influence is so pervasive and constant that individuals are seldom aware they are activated (Gaglio and Katz 2001). Put differently, the idea of chronic schema is that they, mostly unconsciously, guide almost all individual's perceptions and interpretations, thereby automating information processing since attentional or intentional control are not necessarily involved (Norman and Shallice 1986). Many studies indicate that individuals possess quite temporally robust cognitive patterns and preferences; for instance regarding their so called regulatory focus (e.g. Higgins 1998; Higgins and Silberman 1998). In summary, it could be said that individuals show a certain degree of chronic styles and preferences (Baron 2004).

It has already been argued that, notwithstanding methodological individualism, the situations the cognitive operations are executed in are of significant importance. This seems particularly palpable considering the social-constructivist approach alleged here. The intruding question is rather which aspects, and in which way, influence human information processing. A virtually infinite number of situational variables such as culture or society could be mentioned that might shape an individual's cognitive processing (see e.g. Amabile 1983, 1996; Kirshner and Whitson 1997). However, the probably most evident aspect, which can be assumed to influence human cognition, is the domain an individual is situated in while processing information. Quite surprisingly, the traditional experimental tasks with which thinking mainly was, and still is, investigated, were not capable of shedding significant light on the influence of the particular domain on cognition (Brown and Walter 1983; Hadamard 1945; Spitz and Borys 1984). Consequently the question arises whether scientists, artists, or economic agents are dealing with fundamentally different problems? And if so, to what extent are they similar and how do they differ? It seems that differences are not only of terminological nature but also significant distinctions within the processes can be observed (Dudek and Cote 1994).

However, even if the continuum view of creativity is adopted, it could be asked whether a general creative thinking-process model can be conceived sufficiently general to account for all, or at least a high number of, different settings, or if there are significantly different processes at work in creative thoughts, e. g. in arts, sciences, or economics (Lubart 2001). This question is of particular interest in the context of the present work since it is intended to transfer insights from other domains to the entrepreneurial field. And indeed, several authors have developed models of the creative process for a particular task environment. Nevertheless, it should be kept in mind that a huge part of the overall work on creative processes has sought the generic process or the general model independent of a domain or setting (Lubart 2001). Similarly, the present work assumes the position that, due to domain-invariant mechanisms, it is not only principally possible but also sensible to develop a general model of creative thinking. Notwithstanding, in adopting findings from other domains than economics caution must be exercised.

For example, many studies on creativity and problem finding have been done by investigating artists. Artists are rather looking for a symbolic equivalent as solution that is emotionally releasing and original to them; such problems are neither original nor resolvable. In other words, artists do not deal with matter; they deal through matter to come to terms with internal human problems (Dudek and Cote 1994). Just to mention a few, Ghiselin (1952) investigated problem finding in dancing and writing. Moore (1985) replicated the study of Getzels and Csikszentmihalyi (1976) with student writers that showed a strong correlation between creative outcome’s quality and a high tolerance for chance in the finished product. More recently, Sapp (1995) conceived a process model for artistic creativity based on general creative problem-solving models and Nemiro (1997) proposed a process model for actors, by linking general preparation, rehearsal, and performance activities to the stages described in Amabile’s (1996) model. These examples already allow the conjecture of a different meaning of emotional involvement or motivation between arts and other tasks. It can be assumed that emotions play a significantly more critical role in arts than in economics.

However, the concept of problem finding originated in the field of science, already mentioned by the quotations of famous persons in the previous chapter that finding the right scientific problem is regarded as probably more important as finding the correct solution to it (Dudek and Cote 1994). The commonly accepted understanding of the science process as resolving inconsistencies within existing paradigms facing inconsistent data implies that a considerable problem finding activity is involved that is aimed at discovering ways of reformulating concepts in such a way that gaps and anomalies can be patched up to confirm the explanatory adequacy of the existing paradigm. Different studies have been done on the problem finding processes of creative scientists (see for example Barron 1963; Bruner 1963; Roe 1953; Beveridge 1957; Klahr 2000).

In 1980, Busse and Mansfield proposed a model for scientific creativity consisting of five stages: (1) selection of a problem to solve among several possible problems, (2) engagement in efforts to solve the problem, (3) setting of constrains on the problem solution, (4) change of the constraints and restructuring the problem, and (5) verification and elaboration of the proposed solution. Other studies were more interested in particular aspects of problem finding and -solving in the domain of science: For instance, the fact that the main informational input for problem finding seems to be the tacit knowledge of the researcher's mentor, e.g. his PhD supervisor (Subotnik and Steiner 1994); or alternatively, that it is important to involve the audience, the scientific community, in problem finding, i.e., identifying problems worthwhile to investigate (Overington 1977; Zuckerman 1977). It could be argued that creative thinking in sciences is typically characterised by lower emotional involvement than in economic situations. Concluding, it seems likely that information processing leading to creative output varies between domains and, therefore, findings in other domains cannot be adopted unconsidered to economic situations.

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[x] "Cognitive science can also be defined as, roughly, the intersection of the disciplines of computer science (especially artificial intelligence), linguistics, philosophy, psychology, cognitive anthropology, and the cognitive neurosciences." (Reilly, 2004, p.110)

[xi] As Polanyi puts it: "For, as human beings, we must inevitably see the universe from a centre lying with ourselves and speak about it in terms of a human language shaped by the exigencies of human intercourse. Any attempt rigorously to eliminate our human perspective from our picture of the world must lead to absurdity." (Polanyi 1962).

[xiii] Lachmann et al. bring a vivid analogy for the fundamental problem: "In this regard we see an appropriate parallel between our science and that of the cell endocrinologist who likened his work to that of an industrial spy. Sitting on a hillside above a factory with field glasses, he watches railroad cars arrive with raw materials. They are taken into one end of the factory, while at the other end trucks pick up completed

product. The spy's job is to figure out what transpires in the factory. Every once in a while he can send in a car of materials he has selected, and later he can see what comes out; but he cannot take a trip through the factory." (Lachmann et al. (1979), p. 123)

[xiv] An illustrative example is the following telegram, supposed to come from France: "PLEASE SEND ME FIFTY DOLLARS AMERICAN EXPRESS NICE LETTER OF EXPLANATION FOLLOWS LOVE YOU". It depends on the geographical knowledge of the reader, whether he expects to receive a nice letter off explanation, or is supposed to send the money to the town of Nice in France. (Massaro and Cowan 1993).

[xv] Please note that information confirming previous information involves novelty in the sense that the insight of confirmation is new

[xvi] An illuminating analogy it the situation of pedestrians crossing a bridge. It is more important t estimate the delay in one pedestrian's passage as a function. Of the number of others hoping to cross simultaneously, than to determine whether the pedestrians cross on abreast or several abreast.

[xvii] "Although it is a modern truism to say that we live in culturally constructed worlds, the thin surface of cultural construction is dwarfed by (and made possible by) the deep underlying strata of evolved species-typical cognitive construction." (Cosmides and Tooby, 1995, p. xi)

[xviii] It might not be scientifically sophisticated but William James has a good point in stating that "Everyone knows what attention is. It is the taking possession by the mind in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought.[…]. It implies withdrawal from some things in order to deal effectively with others."" (James 1890, p.

[xix] Please note that the store is the "receptable" how Styles (2005) calls it, not the memory itself.

[xx] The limited processing capacity can be experienced by, for instance, multiplying two large numbers. While operating the multiplication, an individual has to store sub-products for further calculations. Soon, this leads to memory overload.

[xxi] Imagine showing a child to ride a bicycle. Obviously, instructions can be given but actually it must be shown by action.

[xxii] "What gives colour, vitality, life, and in short, originality to the final product is the intense involvement in the task […], the great eagerness and desire to 'make it original', fresh and new, to stick at it until it reads that way to them." (Dudek and Cote 1994, p. 138)

[xxiii] "All problems have an affective component. If they do not, they would no be perceived as problematic (and worth one's effort). Problems by definition have goals – usually referred to as solutions – and these are presumably what incites or motivates individuals. Even with the simple definition of a problem as anything which is between an individual and a goal, there is an assumption that the goal is of interest or in some way needed. Interest and need both reflect affective states; ergo the concept of problem assumes an affective condition." (Runco 1994, p. 278)

[xxiv] This should not be seen as an argument supporting a mechanistic view on the human mind (see the ontological discussion in chapter II.A.1).

"Why can't entrepreneurship scholars see useful theory and methods for exploring opportunity that already exist in intellectual spaces so closely related to what they are studying?" (Gartner and Shaver 2004, p. 42)

IV. A Cognitive Model of Opportunity Recognition

This central chapter starts with reviewing research efforts on entrepreneurial cognition, in particular such dealing with the role of the two central cognitive elements, information processing and knowledge, in entrepreneurial behaviour. Delineating the field allows conceiving opportunity recognition as creative thinking in part B of chapter IV; these considerations are aimed at pointing out the particular stance for modelling the phenomenon. This seems necessary since heterogeneity prevails in research on entrepreneurial cognition. Therefore, basic assertions, summarising important issues introduced in previous chapters, are given in part 2 and taken as granted afterwards. After the third section of part B has presented a general framework of creative thinking as reference model, the last part C, finally, introduces cognitive processes executed in opportunity recognition in some more detail. For each of these processes, several cognitive styles as preferences for types of information are discussed. Opportunity recognition is here dissected in three major steps, representing the section of the chapter's final part: the conception of an initial problem representation, its updating by information encoding from the external world and activation of knowledge categories from memory, and the combination and reorganisation of such categories, probably producing creative outcomes of the thinking process.

A. Opportunity Recognition, Entrepreneurship, and Cognition

1. Entrepreneurial Cognition Research

Against the background of the arguments given in chapter II and III it is not surprising that during the last decades many scholars tried to explain the phenomena of entrepreneurship as a function of the types of people engaged in entrepreneurial activity; however, this perspective resulted in a neglect of the role of opportunities (Eckhardt and Shane 2003). In 1960s and 1970s a variety of studies (e.g. McClelland 1965) intended to shed light on personalities, backgrounds, early experiences, and traits reported by entrepreneurs and non-entrepreneurs (Baron 1998; Ucbasaran 2004). However, the rationally inferred conviction "[…] that these people were somehow distinct […]." (Mitchell et al. 2002, p. 95) could not be corroborated empirically with these studies since they showed weak, disconfirming, or non-significant results (Low and MacMillan 1988; Mitchell et al. 2002; White et al. 2003; see for an overview Pendergast 2003). Not even one unique set of personality traits could be reported by these research efforts (Mitchell et al. 2002). It is argued that the main weakness of such a person-centric perspective lies in the assumption of stable differences among economic agents' personalities and economic situations; considering that entrepreneurial activity is episodic, it is unlikely to find rigid personal attributes with a high explanatory power explaining why some economic agents engage in entrepreneurial activity and others do not (Eckhardt and Shane 2003).

However since then there has been a shift in the focus of research in the field of entrepreneurship from the former attempts to identify individuals in society exhibiting certain entrepreneurial characteristics towards an understanding of the nexus of such enterprising individuals and valuable opportunities (Eckhardt and Shane 2003; Shane 2000; Shane 2003; Venkatamaran 1997). This research shift can be attributed to several insights that economists have gained, thoroughly changing their perspective on the process in which entrepreneurs introduce novelty and change into economic systems.

Although research on entrepreneurship and opportunity identification seems to be quite heterogeneous, offering explanations and theories from a wide range of perspectives and fields, there seems to be a focus on economic and psychological aspects of opportunity recognition, which can be justified by pointing out that "[…] the entrepreneur faces two distinct, but interrelated problems: an economic problem and a cognitive problem." (Suchman et al. 2001) Some scholars even think that a cognitive perspective can not only contribute to opportunity identification's understanding, but also function as a general theoretical framework (Baron 2004a). The central assumption on which such a view is based is that entrepreneurship concerns itself with distinctive ways of thinking and behaving (Mitchell et al. 2007). It is assumed that entrepreneurs are different by modifying the categories of their framework (Lane et al. 1996) or sometimes even by adding a new category (Yu 2001): they are somehow creative. "Creative activity thus involves the shifting together of different sets of reference frames that would usually be ordered differently and be seen incompatible - until something clicks into place as a new way of looking at how things fit together." (Yu 2001, p.

54) In other words, by making such a discovery, the entrepreneur escapes from the extant patterns of interpretation and reorganises ideas into new sequences (deBono 1992; Thayer 1988).

Accordingly, "[…] entrepreneurs are those who incubate new ideas, start enterprises based on those ideas […]." (Holt 1992, p. 11) Such a definition points out that these economic agents are characterised by a certain aptitude that enables them to derive new ideas. Viewed from this perspective, another important question, would be how market environments are represented and interpreted in the mind of the entrepreneur so that opportunity identification occurs? Further, it should be clarified if and, in case the answer is yes, these representations and interpretations differ from those of other economic agents? (Shaver and Scott 1991) This is exactly what will be examined in the present work.

Such a framework could not solely serve as a fundament for further research, but also for entrepreneurship education.[xxv] Indeed, there exists a variety of studies on entrepreneurial cognitive processes and knowledge (see e.g. Mitchell et al. 2002, 2007). Among such attempts, it appears to be rather evident to fall back on extant psychological research, given the emphasis on the human dimension of thinking in research on entrepreneurship in general and in research on the identification of entrepreneurial opportunities in particular (Forbes 1999).

A cognitive perspective has added greatly to the understanding of virtually every aspect of human behaviour - particularly economic actions taken and decisions made (Hesse 1990; Ucbasaran 2004) - to which it has been applied, so why not to the domain of entrepreneurship (Baron 1998)? Therefore, in order to overcome incomplete understanding, it seems necessary to investigate the behaviour of economic agents from a cognitive perspective; in the context of the present work particularly the entrepreneur (Hitt and Tyler 1991). In general, such research could be named cognitive entrepreneurship research (Mitchell et al. 2004). Defining the field that is comprehended by the term it could be said: "[E]ntrepreneurial cognitions are the knowledge structures that people use to make assessments, judgements, or decisions involving opportunity evaluation, venture creation, and growth. In other words, research in entrepreneurial cognition is about understanding how entrepreneurs use simplifying mental models to piece together previously unconnected information […]." (Mitchell et al. 2002, p. 97) Leaning more on the two basic cognitive elements, "[…] entrepreneurial cognition can therefore be defined as a set of cognitive processes and knowledge structures that explain how entrepreneurs think, perceive, process information, and learn in relation to the identification and exploitation of opportunities." (Ucbasaran 2004, p. 76)

Touching briefly the history of entrepreneurial cognition research it can be said that the terms of entrepreneurs' cognitions and entrepreneurial cognition were introduced in the early to mid-1990s (Busenitz and Lau 1996; Mitchell et al. 2002). This research was an effort aiming at overcoming the palpable failure of trait theory (Hindle 2004). Indeed, in contrast to unsuccessful attempts focussing on personality, the body of research addressing entrepreneurial questions from a cognitive perspective pointed to the conclusion that entrepreneurs differ from other individuals with respect to some cognitive processes (Baron 1998). First research in this field that received major attention was done in the areas of cognitive biases and heuristics in strategic decision making, as well as feasibility and desirability perception, planned behaviour and self-efficacy (Mitchell et al. 2002). After further studies on risk-taking (see Palich and Bagby 1995) and cognition-based entrepreneurship education, Baron (1998) came up with ideas concerning the role of several cognitive mechanisms like counterfactual thinking, affect infusion, attributional styles, planning fallacy, and escalation of commitment. Then, other scholars focussed on cognitive errors and models explaining heuristic-based logic of entrepreneurs (Mitchell et al. 2002). This research can be seen in a naturalistic tradition that accepts the practicality of heuristics not regarded as sources of errors but as effective decision means in ill-defined and dynamic situations (Bryant 2007).

Such approaches are all based on the central conjecture that there exist cognitive characteristics underlying entrepreneurial action that can help to explain why some individuals are able to do such actions, while others are not, respectively only limited in their capability to do so (Baron 1998, 2004). Most generally, a cognitive perspective can contribute to an understanding of the attributes (prior knowledge, cognitive mechanisms, heuristics, or creative abilities) a potential entrepreneur is supposed to have. However, it should be noted that this does not directly refer to the process of acquiring such attributes; this rather belongs to the domain of entrepreneurial learning (Corbett 2005). Saying this, an important terminological distinction must be made between knowledge, cognition, and learning; while knowledge is a static concept, which is highly intertwined with cognitive processes, learning is the process of knowledge creation by transforming experience. These processes of learning are doubtless significant for entrepreneurship and opportunity recognition but are not addressed here in the present work since they are inherently different from cognitive processes and, thus, a treatment would go beyond the scope of a work like the present (see instead e.g. Corbett 2005; Minniti and Bygrave 2001).

However, in hope to find more satisfying explanations for the assertion of a specific entrepreneurial cognition, more recently many scholars have used a cognitive approach to investigate the entrepreneurial process. They aim at finding out, how entrepreneurs think and make their strategic decisions (Krueger 2003; McGee 1995), focussing on such different aspects as risk perceptions (Simon et al. 2000), cognitive biases in different entrepreneurial decision contexts (Simon and Houghton 2002), decision making biases and heuristics (Busenitz and Barney 1997) (see for more examples of more general studies Baron 1998; Forbes 1999). All these approaches share the basic conjecture that entrepreneurs have a unique mindset (Alvarez and Busenitz 2001) and could be seen as similar to the attempts of scholars in Austrian economics to refine or elaborate the role of subjectivism in this regard (see e.g. Yu 2001).

Reviewing the relevant literature, Mitchell et al. (2004, 2007) have identified some questions and issues that are specific to the entrepreneurial cognition domain and might serve to delineate the field with which research on entrepreneurial cognition mainly deals. These refer to individuals' decision to become an entrepreneur, the recognition and exploitation of opportunities, strategic decision making and its impact on the venture, general thinking processes of entrepreneurs compared to other individuals, and the measurement of cognitive concepts in non-laboratory settings, summarised in Figure 29.

Questions and Issues Specific to the Entrepreneurial Cognition Domain
Why do some people and not others choose to become entrepreneurs? (Simon et al. 2000)
Why do some persons but not others recognise opportunities for new products or services that can be profitably exploited? (Gaglio and Katz 2001)
How do entrepreneurs think and make strategic decisions? How do these differences lead to competitive advantages and disadvantages? (Busenitz and Barney 1997; Mitchell et al. 2000, 2002, 2007). How do these differences lead to competitive advantages & disadvantages? (Alvarez and Busenitz 2001)
Do entrepreneurs think differently than other, business people? (Busenitz and Barney 1997; Gaglio and Katz 2001; Mitchell et al. 2002; Mitchell 2003)
Measurement of cognitive concepts in non-laboratory settings. (Mitchell 1994; Mitchell et al. 2000)

Figure 29 Question and Issues Specific to the Entrepreneurial Cognition Domain (Mitchell et al. 2004, p. 508).

Methodologically, the popular approach to base studies on the differences between experts and novices has been adopted in the field of entrepreneurial cognition, distinguishing between habitual and novice entrepreneurs (e.g. Birley and Westhead 1993; Ucbasaran 2004; Westhead and Wright 1998). Such research intends to find cognitive differences between habitual entrepreneurs, who own or have owned at least two businesses, and novice entrepreneurs, who only own one business and do not dispose of further experience (Ucbasaran 2004). From a cognitive perspective these studies assume that habitual entrepreneurs possess something like an entrepreneurial mindset, but corroborating findings were not obtained (Ucbasaran 2004). Besides the argument regarding drawing a suitable sample already described in chapter II.B.2, scholars have suggested that such studies have not considered cognitive heterogeneity among each of these groups. It is argued that the inaccurate distinction between habitual and novice entrepreneurs doe not account for interpersonal differences regarding cognitive processes and knowledge structures (Ucbasaran 2004).

Summarising what has been said about this research in this field, already many aspects of entrepreneurial activity have been targeted from this perspective, reason why a detailed discussion would fill whole chapters of its own that would only marginally contribute to the purpose of the present work, particularly considering that it is still a rather young research stream on the move (Mitchell et al. 2007). Nevertheless, it is striking that many models have been transferred from the field of cognitive psychology to entrepreneurship, nevertheless arguing that entrepreneurs might exhibit different decision making patterns than non-entrepreneurs, based on concepts like signal-detection theory or regulatory-focus theory (Baron 2004a). It should become clear that entrepreneurs are tested as to their difference in already existing psychological dimensions. This orientation towards existing research has the methodological advantage that the articulation of a theoretically rigorous and empirically testable approach is possible, which might allow to systematically explain the role of the individual in the entrepreneurial process (Mitchell et al 2002). However, in accordance with general research on cognition, all scholars in the field of entrepreneurial cognition highlight the role of the two basic cognitive elements: knowledge and cognitive processes (Mitchell et al. 2002; Shane 2003). Thus, the present work focuses on basic cognitive processes and knowledge structures rather than on psychological concepts; therefore, more has to be said about findings as to these more elementary aspects of the entrepreneurial mind in general and in recognising entrepreneurial opportunities.

2. Cognitive Processes

Generally, cognitive processes of entrepreneurs have been found being distinct from other economic agents, in particular of managers in most, or probably even all, categories of personal variables (e.g. Busenitz and Barney 1997; Wright et al. 2000). Usually it is argued that entrepreneurs are more often than other individuals situated in situations of cognitive overload, which matters since human information processing capacity is limited; such situations usually involve a high degree of uncertainty for which no appropriate knowledge structures exist. Further, entrepreneurs are typically assumed to be more frequently exposed to situations in which emotions run high, leading to more cognitive biases and errors. Such situations seem to be typical for entrepreneurs since it seems that they often face new, unpredictable, complex and ill-defined situations (Baron 1998; Katz 1992; Busenitz and Lau 1996; Busenitz and Barney 1997; Baron 1998; Simon et al. 1999). Such typical entrepreneurial situations normally impose particular conditions on entrepreneurs, such as high uncertainty, novelty, time pressure, and stress (Corbett 2005). The emphasis that is put on a cognitive view on individuals in particular situations already calls for social-cognitive approaches for investigating entrepreneurial behaviour (Mitchell et al. 2007).

It is often emphasised that entrepreneurs, situated in such ill-defined situations, are subject to many cognitive biases, such as a self-serving bias for instance (Baron 1998; Busenitz and Barney 1997; Corbett 2005; Mitchell et al. 2002; Simon and Houghton 2002). However, this has been found to result in an entrepreneurial thinking approach seeming to use heuristics and cognitive-based reasoning more extensively than managers (Baron 1998; Baron and Ward 2004; Busenitz and Barney 1997; Corbett 2005; Mitchell et al. 2007; Simon et al. 1999). The term of cognitive-based processing means that individuals process all information carefully and thoroughly (Kullik and Perry 1994); while the former type of entrepreneurial processing implies that individuals may faster come to results of their processing, thereby attaching less value to thoroughness and carefulness.

However, in creative thinking it is generally assumed that individuals apply decision heuristics, instead of executing algorithm-like processes, often because no specific methods for solving the problem are known (Mitchell et al. 2007). Shaver and Scott (1991) name three more cognitive heuristics that particularly seem to bias entrepreneurs and are presented by giving an example concerning the question of whether a restaurant will fail in its first year of operation. (1) An individual that has recently heard about a restaurant closing down will be most likely subject to the availability heuristic that it will give a higher estimate of failure than a person without having heard about unsuccessful restaurants in a long time. (2) An individual that regards the restaurant at hand as a prototype of a successful enterprise will give a lower probability of failure than a person for whom the restaurant resembles unsuccessful ones (the representativeness heuristic). (3) Thirdly, the concept of anchoring heuristic refers to the situation that an individual knowing that three local restaurants have failed will give a lower estimate of failure than one that has hear of 10.000 unsuccessful restaurants nationwide.

Besides applying heuristics and being subject to biases, it seems that the involvement of personal beliefs and fast decision making characterises entrepreneurial cognition. In turn, managerial cognition is assumed to be more accurate and optimal, rather methodical and factual-based, therefore more resembling to a systematic information processing approach (Ucbasaran 2004). It seems that without heuristic-based logic, the recognition and exploitation of entrepreneurial opportunities would become to overwhelming and costly, demanding to much cognitive capacity since situations entrepreneurs are typically confronted with situations that require the application of quicker rules of thumb, instead of rather exhaustive or algorithmic solutions (Pech and Cameron 2006).

Similar to heuristic-based processing, Ucbasaran (2004) argues that this affinity of entrepreneurs can be seen as similar to the forward-looking form of intelligence (Gavetti and Levinthal 2000). Most generally, this means that an individual's beliefs or expectations about the linkages between its choices of actions may influence subsequent actions and outcomes. Such intelligence allows any individual to evaluate information and alternative choices of action, without actually doing them; therefore this could be called off-line evaluation. In turn, the term on-line evaluation refers to such efforts which require at least partial implementation of an alternative, if the efficacy is supposed to be evaluated (Gavetti and Levinthal 2000; Ucbasaran 2004).

It can be concluded that economic agents apply timely rather stable patterns of information processes to a given situation, which are stored as a schema, e.g. as a script, in the agent's memory. Expressed differently, economic agents exhibit a personal way, a style or preference configuration, as how information is processed in a problem situation. In fact, first studies were already capable of generating supporting evidence for the assumption that particular cognitive styles serve better to recognise entrepreneurial opportunities than others. Corbett (2002) found that an individual's processing style of a rather intuitive manner seem to identify more opportunities than those exhibiting a rather analytical style. In the present work it is assumed that such cognitive styles are indeed rather inflexible over time and can, thus, be considered a personal characteristic along an entrepreneurial process (Corbett 2005).

Such a conceptualisation, resembling to a cognitive style for which it is often stated that entrepreneurs differ compared to managers, is the strategic focus, style of self-regulation, or regulatory focus; terms which all refer to the same idea that individuals do have different ways of setting goals to which they adjust their behaviour (Crowe and Higgins 1997; Higgins 1998; Higgins and Silverman 1998; Werth 2004). Approaches choosing such a perspective seem promising for entrepreneurship research because they not only consider an individual's cognitive processes, but also its motivation to act in a specific manner (Mitchell et al. 2007). However since this concept will be introduced in some more detail in chapter IV.C.1, it should be enough to say at this point that managers seem to dispose of chronic schemas that guide their thinking and behaviour mainly by issues such as protection, safety, and responsibility, which is called a prevention focus. In turn, entrepreneurs seem to engage in a promotion focus that makes them think of advancement, growth, and accomplishment as well as directing attention on potential gains and approaching success, while focusing less on potential losses and avoiding failure (Brockner et al. 2004; Bryant 2007; Corbett and Hmieleski 2007; McMullen and Shepherd 2002).

Related to this, studies exist suggesting that entrepreneurs are optimistic and generally believe that things will turn out better than rational considerations suggest (Krueger 2003). Put differently, it seems that entrepreneurs are relatively high in self-efficacy, which means that they believe that they can successfully accomplish whatever they plan to accomplish (Bryant 2007; Chen et al. 1998). Altogether, it might be stated that entrepreneurs do have a distinctive pattern of self-regulation that might be termed Entrepreneurial Regulatory Framework and is dominated by a chronic promotion focus (Bryant 2006).

Yet another cognitive aspect in which entrepreneurs might differ from other economic agents is their way of learning; it is hypothesised that they learn differently from experiences and that this particularly affects their future problem-solving efforts (in the wider sense) (Daft and Weick 1984; Ucbasaran 2004). Regarding this issue, it can be differentiated between higher-level and lower-level learning. The former is based on the formation and the use of heuristics to generate new insights into solving ambiguous problems (Lei et al. 1996) and usually attributed to entrepreneurs (Ucbasaran 2004). In turn, the latter term is associated with rather routinised learning and repetitious observations, which is only temporary and rather imitable since the underlying policies or values are rarely changed (Fiol and Lyles 1985; Ucbasaran 2004).

Concluding, entrepreneurial cognitions are typically assumed to be heuristic-based, off-line, forward looking, and guided by higher-level learning (Ucbasaran 2004). Further psychological mechanisms that are assumed to differentiate the entrepreneur from other economic agents include know-how, memory and filtering devices, intelligence, and enjoyment levels (Pech and Cameron 2006). However, such generalised characteristics should not mislead to assume that entrepreneurs are homogeneous as to their cognitive processes. Rather, studies indicate that they show quite heterogeneous processing patterns (Westhead and Wright 1998; Woo et al. 1991). This might be because such dichotomies entice to generalise cognitive behaviour, which, consequently, calls for models that dig deeper into entrepreneurial cognition, as the present study aims at doing for opportunity recognition by focussing on information-processes. However, as already underlined in general, also cognitive approaches to entrepreneurship should clearly distinguish between explanations of the main stages of the entrepreneurial process: opportunity recognition and exploitation. While the outcome of opportunity exploitation is the creation of a new venture, the result of the process of opportunity recognition from a cognitive perspective is defined as the conscious, verbalisable idea in the mind of one or a group of persons that they have recognised an entrepreneurial opportunity (Baron 2004a). Accordingly, scholars in entrepreneurship emphasise that recognition should be separated form the detailed evaluation both potential value and feasibility of the opportunity at hand, which is rather considered as belonging to the exploitation stage in the entrepreneurial process (Ardichvili et al. 2003; Baron 2004a).

Without digging to deep into the characteristics of entrepreneurial information processing in the process of opportunity recognition, some general statements are given before information processing is tackled more thoroughly. Generally, research on opportunity recognition from a cognitive perspective is based on the conjecture that individual differences in knowledge and information processing are capable of explaining the capability to recognise entrepreneurial opportunities to a high degree (Baron 2004a; Corbett 2005; Shane 2000; Shaver and Scott 1991; Ward 2004); i.e. to explain individual differences in the relative assessment of the market event or situation (Kirzner 1979). It is usually hypothesised that the cognitive processes underlying opportunity recognition are much the same across all individuals; basic cognitive processes enable specific persons to perceive, and know that they perceive, the potential for something economically new and valuable (Baron 2004a).

As pointed out, it is generally assumed that entrepreneurs proceed with heuristic-based logic in such cognitive processes. This is also argued for the discovery of entrepreneurial opportunities since they can rarely be derived by factual-based and linear cognitive process (Ucbasaran 2004). On the contrary, entrepreneurs are able to significant thinking leaps, leading to innovative ideas, which are often not linear or factually based (Alvarez and Busenitz 2001). Some scholars argue that this is because in such dynamic environments rather rational models of decision making are not ideal (Kahnemann and Tversky 1974; Krabaunrat and Phelps 1998). Indeed, comparisons between alert and non-alert economic agents suggest that the former possess "[…] a distinctive set of perceptual and reasoning behaviours that may not necessarily depend upon information gathering efforts nor upon cues inherent in the information." (Gaglio and Katz 2001) Accordingly, "[…] opportunity recognition refers to the active, cognitive process (or processes) through which individuals conclude that they have identified the potential to create something new […]." (Baron 2004a, p. 52) Despite such findings (e.g. Gaglio and Katz 2001; Ko and Butler 2003), many scholars still criticise the lack of empirical support for this statement (see e.g. Ward 2004).

Various scholars in the field of opportunity identification were inspired by Kirzner's concept of alertness and intended to approach the notion from a cognitive perspective since the concept was seen by Kirzner (1979) himself as a distinctive set of perceptual and processing skills (Gaglio and Katz 2001; Yu 2001). Some of these emphasise the role of the self-interest motive that triggers of alertness and is called selective entrepreneurial attention (Gifford 1992). Others argue that self-competition motivates individuals to be alert to entrepreneurial opportunities (Yu 2001); i.e. referring to individuals that aim at realising things and test their self-ability (Gilad et al. 1988; Khalil 1997). Based on the general fundament laid by Kirzner, the central assumption is that the potential for opportunities emerges from complex patterns of changing conditions in economic systems. Ontologically, this presupposes that opportunities exist in the external world in the sense of a pattern of events or stimuli that can be perceived by individuals.

Hence, Baron (2004a) argues that opportunity recognition can be modelled as pattern recognition. Assuming that opportunities exist in the external world as complex patterns of observable stimuli, he names several processes of pattern recognition, developed in the field of cognitive psychology, which might help to explain, why some individuals can accurately perceive such opportunities. Put briefly in the context of the present work, these models of pattern recognition might explain, why some individuals recognise an entrepreneurial opportunity in a specific situation, while others do not. An individual's available knowledge structures are of particular importance since incoming stimuli are compared to what is stored there (Baron 2004a; Baron 2004b; Baron and Ensley 2003). This perceptual approach definitely contributes to the understanding of thinking process involved in opportunity recognition. Concerning this view, it can be criticised that the assumptions necessary for this approach are not realistic: Is there really a prototype or exemplar individuals have in mind, how an opportunity looks like? Such models rather apply to the recognition of given objects in the external world, like houses or birds. Admittedly, every instance of these objects is unique, but to a largely lesser extent than entrepreneurial opportunities. Therefore, the author argues that such perceptual approaches could be used to understand certain types of entrepreneurial opportunities, such as arbitrary or adaptive ones, which include less novelty than others.

However, entrepreneurial alertness can also be conceptualised as a general schema, a script, guiding information processing (Gaglio and Katz 2001). The most popular of these 'cognitive alertness' approaches contends that individuals raise alertness when they encounter a problematic situation, which is consequently called the problem-solving argument (Yu 2001; Choi 1993, 1999), referring to problem-solving in the narrower sense. The study of Gaglio and Katz (2001) points to the existence of specific kinds of schemas that can be very helpful in recognising entrepreneurial opportunities. Based on a refined conceptualisation of Kirzner's approach they call such type of schema entrepreneurial alertness. Such a cognitive framework is assumed to assist individuals in searching for and noticing change and market disequilibria in economic structures. Further, it assists in responding to information that does not fit into their current schemas, and, finally, in adjusting this extant schemas on the basis of such non-fitting information.

Their research suggests that individuals with this specific schema tend to be objectively accurate and disposing of more complex information regarding the nature of change, i.e. they have more accurate mental models of the world. In conclusion, their work indicates that some individuals have a superior entrepreneurial alertness since they have more complex and adaptive mental frameworks. This means that "[…] the alert individual or entrepreneur must perceive the market environment correctly (veridical perception); identify the true driving forces and critical factors; and infer the real relational dynamics among these elements (veridical interpretation)." (Gaglio and Katz 2001, p. 97) Based on the fundamental concept of entrepreneurial alertness it could be hypothesised that the central characteristic a schema guiding cognitive processes of alert economic agents must exhibit is to direct attention towards the novel, unusual or contrary in a situation and guiding the information processing towards the integration of the unusual event (Gaglio and Katz 2001). Gaglio and Katz (2001) briefly model the cognitive processes involved in opportunity recognition, emphasising differences between non-alert and alert individuals or economic agents.

As depicted in Figure 30, initially, the latter do not accept information perceived from the external world as given, but may simply have the habit of looking for change. Eventually, this habit might result in the challenge of the current understanding of an economic situation. In this case the agent has two options: ignoring respectively discounting the new possibilities or assessing their impact on the existing relevant mental model of the external world.

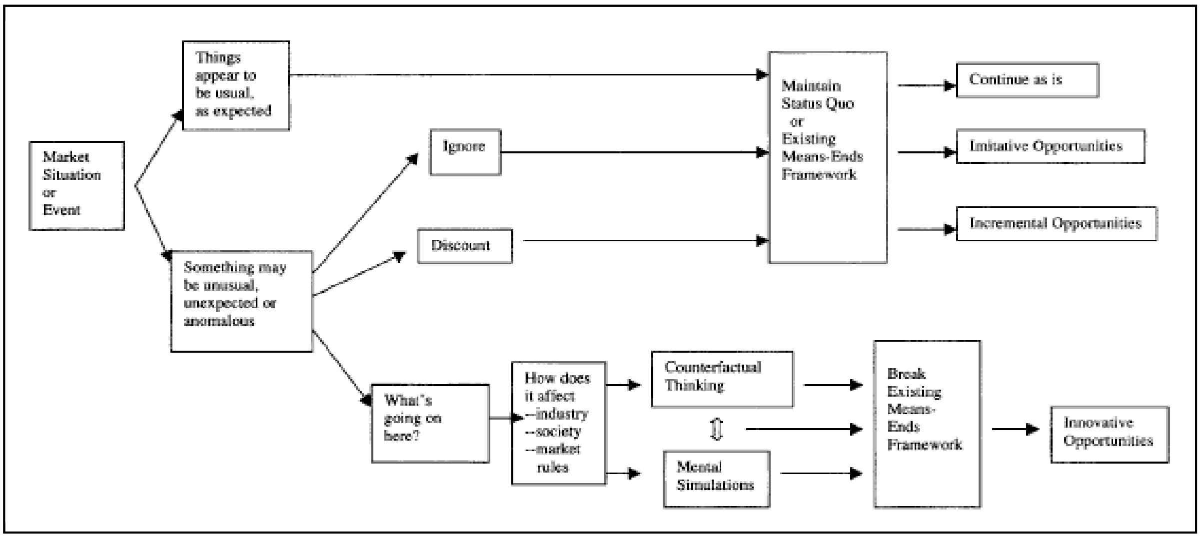

Figure 30 Cognitive Underpinnings of Alertness and Opportunity Recognition (Gaglio and Katz 2001).

Coming to the latter conclusion an economic agent executes cognitive processes (in this particular model counterfactual thinking and mental simulation) leading to a radical alteration of the existing means-ends framework' contents or relational dynamics, named an innovative opportunity (Gaglio and Katz 2001). Based on previous research on entrepreneurship and cognition, Gaglio and Katz (2001) derive a set of hypotheses based on this general notion of alertness and opportunity identification. Although their hypotheses should not be adopted unreservedly and assume a Kirznerian stance, the aspects discussed are of some importance. These hypotheses are depicted in Figure 31.

H_1:	In any given market situation, alert individuals are more sensitive to signals of market disequilibrium than non-alert individuals.

H_2:	Alert individuals will change their schema to accommodate non-matching information; non-alert individuals will change the information.
H_3:	In any given market situation, alert individuals will be impervious to framing effects will non-alert individuals will succumb.
H_4:	Non-alert individuals will satisfice; alert individuals will seek objective accuracy.
H_5:	Alert individuals will have more complex schema about change in the market environment than the non-alert.
H_6:	Alert individuals will have more complex schema about their industry or social environment or market process or any combination thereof.
H_7:	Alert people engage in counterfactual thinking that undoes causal sequences; non-alert people engage in counterfactual thinking that undoes the unusual cause only.
H_8:	Alert individuals are more likely to break the existing means-ends framework than non-alert individuals.
H_9:	Alert individuals are more sensitive to the profit potential of ideas and events than non-alert individuals.
H_{10}:	Individuals can be categorised as demonstrating one of four outlooks: assessing (the fully alert individual), discounting (the marginally alert individual), dismissing (the uselessly alert individual) or uninterested (the non-alert individual).
H_{11}:	Non-alert individuals will activate a schema from the set of schema already existing and defined by the market.

Figure 31 Hypotheses Regarding Alert Economic Agents (Gaglio and Katz 2001).

Picking only some of the most interesting hypotheses to the present work, economic agents disposing of an alertness schema have a higher sensitivity to the signals emitted by sources of entrepreneurial opportunities. However, it is not said that non-alert individuals do not recognise such signals, but are assumed to accommodate new information, that is to make sense of this signals leading to the conclusion that the existing means-ends framework is still the best. In general terms, only those economic agents are alert who attempt to integrate the perceived anomalies or inconsistencies into a pattern and subsequently form hypotheses that the status quo (the current means-ends framework) may not be the best in that particular situation.

Another interesting question arises considering the case that external stimuli are perceived that do not fit into a stored schema. Individuals could tend to integrate new information within existing knowledge structures by creating new subcategories or causal links that increase the differentiation and complexity of their schema. In turn, an individual could adhere to the schema memorised and reinterpret the incoming information in order to maintain the structure and dynamics of the existing knowledge structures. Similarly, economic agents could succumb framing effects, which impede that they identify entrepreneurial opportunities. Already, Kirzner (1985) suggested that non-alert individuals may inaccurately process information, tending to uncritically accept and use information in its original form, respectively adopt the initial frame of reference (Kahnemann and Tversky 1986). This could mean they fail to recognise that conjectures were never or no longer are appropriate; that they ignore new resources available, i.e., they are too optimistic or pessimistic about resource availability or regarding probable outcomes of actions or decisions (Gaglio and Katz 2001). It could be inferred that some economic agents do not succumb these cognitive errors, thus, possessing a superior capability of identifying entrepreneurial opportunities.

Further to this, Gaglio and Katz (2001) addressed the question whether an optimal effort invested in information processing exists in a given situation. They hypothesise that alert individuals do not satisfice that is apply the first available solution they identify. This corresponds to the view that such a processing strategy usually does not lead to novel outcomes of the thinking process (see chapter III.C.1). Instead it is assumed that entrepreneurs seek for a certain degree of objective accuracy, i.e. put more effort in coming to a more accurate analysis of a situation. However, this hypothesis is rather questionable since, as already said, other studies have indicated that entrepreneurs tend to apply more heuristic-based processing than managers. This could be seen as a weak point or, in turn, as another hint that entrepreneurs do not necessarily equal to alert individuals. Similarly, it could be argued in the present work that based on the denial of objectivity in dealing with information, the hypothesis simply makes no sense at all. Further, it is assumed that alert individuals have a superior ability to link schemas, for instance schemas about industries, social environments or market processes (Gaglio and Katz 2001). As will be pointed out, this could be seen as an ability to combine and reorganise knowledge structures as modelled in the present work.

In summary, although the study of Gaglio and Katz (2001) has brought many important questions to the fore, it is basically different from the present study's approach; their model is based on a realistic stance, in which superior cognition is seen in the degree of correctness, i.e. how veridical it is. It has been argued here that in a constructivist perspective such differentiation makes no sense. However, focussing on psychological aspects, their study remains vague concerning the basic information processes involved in breaking the existing means-ends framework by only including counterfactual thinking and mental simulation. Furthermore, they have a different view on changing a means-ends framework than alleged in the present work, when assuming that imitative and incremental opportunities do not change the prevalent means-ends framework. This is surely correct from a macro-perspective since from this general view nothing significant changes if an imitative opportunity is introduced into a new segment or region of the same market (by what is called a marginally alert individual that could also be called a discounter). Anyway, assuming an individualistic perspective implies that the economic agent at hand does alter the means-ends framework, independently of the extent to which he does it.

Additionally, Gaglio and Katz (2001) do not distinguish between schema of alertness in different economic situations, therefore neglecting the nexus between opportunity and individual. For instance they categorise individuals in groups according to their alertness. Considering the variety of economic situations in real life this point cannot be supported: instead, such a categorisation should include, at least, the second dimension of type of situation with which an economic agent is confronted with. A viable way to account for such aspects seems to consist in modelling opportunity recognition as a 'normal' creative thinking process, trying to extract the basic parameters that distinguish among alert and non-alert individuals (Fiet et al. 2004a).

3. Knowledge

As already pointed out, in reality the two basic cognitive elements cannot be separated from each other since cognitive processes lead to the emergence of an individual's knowledge structures, which, in turn, significantly guide information processing. However, already the early works of the Austrian school have emphasised the role of knowledge in entrepreneurship, as chapter II.C.1 has outlined. Now, instead of repeating these considerations, it is first briefly mentioned to which dimensions of knowledge entrepreneurs are generally assumed to differ from other economic agents. In the general context of entrepreneurship the importance of knowledge via experience has been received high attention (Chandler and Jansen 1993; Cooper et al. 1995; Stuart and Abetti 1990). Such relevant idiosyncratic knowledge in any given situation usually originates from prior non-systematic efforts in from of personal background job experience of simply knowledge in a particular domain, just to mention a few (Bygrave 1997; Lumpkin et al. 2001; Shane 2000). Consequently, the assumed cognitive heterogeneity among economic agents and among entrepreneurs also applies to their knowledge structures (Machlup 1983).

Regarding this issue the literature on entrepreneurial cognition distinguishes at least three aspects, to which individuals can differ: factual knowledge, episodic or experiential knowledge, and metacognitive knowledge. In the general context of entrepreneurship differences relating factual knowledge are particularly likely as to the field of business ownership (Ucbasaran 2004). Such knowledge can be acquired through educational measures or indirect exposure to entrepreneurial activities through various role models (Birley et al. 1999; Krueger 1993). Episodic knowledge is accumulated through personal experiences and could be a result of business ownership experience (Ucbasaran 2004), which might differ as to its magnitude and nature (Stuart and Abetti 1990). Furthermore, it is hypothesised that metacognitive knowledge might be of importance in this context as well since allowing an entrepreneur to avoid cognitive biases in decision-taking, which are likely to be present if heuristics are applied (Bazerman 1990).

In some more detail, metacognitive knowledge should increase an individual's level of awareness as to how to process information and where to locate processing resources to come to a new business idea. Consequently, it is hypothesised that metacognitive knowledge leads to a higher search investment of successful entrepreneurs for additional information in discovering entrepreneurial opportunities (Ucbasaran 2004). Episodic knowledge might have an impact on opportunity recognition as well, in particular if it is related to a particular market and the opportunities in this market or field (Shane 2000). Such knowledge acquired during prior efforts in opportunity recognition may also enable individuals to identify and utilise useful and appropriate sources of information for future opportunity recognition efforts (Fiet et al. 2004b; Ucbasaran 2004). Such specific knowledge is seen as "[…] an understanding of information about people, places, timing, special circumstances, and technology." (Fiet et al. 2004b, p. 4) In a way, specific knowledge is simply ubiquitous given the imperfection of markets, in this case unevenly or asymmetrically distributed information about venture ideas (Bygrave 1997; Kirchhoff 1991).

Basically, it is often suggested that the greater the amount of information available to an individual, the better is its ability to identify entrepreneurial opportunities; and indeed empirical studies showed that knowledge of a domain or business context was significantly positively related to the identification of opportunities in that field (Shane 2000; Shepherd and DeTienne 2001). Models of opportunity recognition consequently tend to include prior knowledge as one of the crucial dimensions in opportunity identification (e.g. Ardichvili et al. 2003: Shane 2003), considering the idiosyncratic cognitive structures reflecting an individual's previous life experience (Baron 2004a).

However, as has been said in general an individual's knowledge structures and cognitive processes are closely interrelated. This also holds true for the fields of entrepreneurship and opportunity recognition: Such idiosyncratic knowledge structures matter depending on the economic situation and the ‘fit’ or relevance of this structures in this situation (Baron 2004a); a central argument why it is important to refer to the nexus between individual and opportunity instead of one aspect solely. Reversely, and supporting this argument, it has been shown that prior knowledge in a certain domain might lead to hubris and overconfidence, that is to entrepreneurs trying to replicate their success in a particular domain into another where it is not applicable (Wright et al. 1997). Similarly, it can be argued that relevant knowledge is sufficient to but not necessary leads to opportunity recognition since an individual’s propensity to store information about experiences in its knowledge structures can provide a bridge to the development of new ideas, but also become a fence in doing this by becoming established schemas (Minniti and Bygrave 2001; Ward 2004). These might result in mental inertia impeding the recognition of entrepreneurial opportunities (Yu 2001). For example, this can happen if information is perceived that is inconsistent with extant knowledge; such schemas can be mental blinders that prevent individuals from perceiving opportunities (Baron 2004a). In this view “[…] lack of entrepreneurship means that actor’s thinking is locked up in old interpretation structures, old concepts and old institutions.” (Yu 2001, p. 57)

Given that time, respectively quickness, is crucial, then economising the acquisition of specific knowledge is one way to improve competitiveness or in other words: to discover entrepreneurial opportunities. Studies suggest that successful entrepreneurs seem to search systematically for such information in known information channels (Fiet et al. 2004b). These channels are frequent, low-cost sources of specific knowledge about possible discoveries and called consideration sets, which represent an opportunity to reduce the searching space or - from a more economic perspective - searching costs (Fiet and Migliore 2001). Such information channels can be customer relations (Hippel 1986), tradeshows or networks; however, providing economic agents with exclusive information about markets. On the contrary, general knowledge has less value for starting up a business, because it can be codified into rules and procedures, which makes it widely available. For this reason, the possessor cannot expect that it yield above average profits (Fiet et al. 2004b).

However, it should be generally noted that dealing with knowledge as a crucial issue in a cognitive account of entrepreneurship does not refer to the simple production of knowledge, but rather to an appropriate transformation into marketable products or services; i.e. the appropriate organisation of knowledge in the entrepreneurial mind. This particularly implies that research and development are not entrepreneurship (Holcombe 1998). Although it might appear to be self-evident if stated so plainly, most new classical models of economic growth underline the role of human capital and the production of technological advances per se in their growth models (Holcombe 2003; see e.g. Lucas 1988; Romer 1990).

The importance of habitual or chronic schemas, with which individuals make sense of the external world guiding thinking, stored in human memory for entrepreneurship was already illustrated in Schumpeter's (1934) seminal work: “All knowledge and habit once acquired become as firmly rooted in ourselves as a railway embankment in the earth. It does not require to be continually reserved and consciously reproduced, but sinks into the strata of subconsciousness. It is normally transmitted almost without friction by inheritance, teaching, upbringing, pressure of the environment. Everything we think, feel or do often enough becomes automatic and our conscious life is unburdened of it.” (Schumpeter 1934, p. 84) It is important to note that such schemas are not subject to frequent self-assessment, but rather work unnoticed by economic agents; such so called ‚routine perception tracks’ provide a robust framework for the interpretation of incoming information (Yu 2001). In general, chronic schemas might lead to varying assessments of a given economic situations among market actors. Schemas activated might vary as to content and quality, i.e., the degree to which they represent more realistic schema superiorly projecting the future and guiding future problem solutions and actions in this specific expectation of future states (Gaglio and Katz 2001).

When dealing with knowledge structures in opportunity recognition, an important distinction ought to be underlined: The interpretation network of the human mind and stored prototypes of entrepreneurial opportunities can not be treated as equal. While the former refers to the ability to recognise or find opportunities, i.e. schemas of alertness, the latter is a static concept of how an entrepreneurial opportunity looks like. However, it has already been said that knowledge in human memory is highly organised, the nature or manner of organisation depending on the type of knowledge at hand (see chapter III.B.2). In sum, this research states that the richer and more interconnected an individual’s cognitive systems are, the more effectively it can perform a wide range of tasks.

This should also hold true for opportunity recognition, which means that analogously individuals, who possess richer - that is more complex and better-developed mental frameworks for organising and interpreting information related to a domain - are more likely to recognise opportunities. It facilitates the task to notice relevant incoming information and to integrate it with existing knowledge structures (Baron 2004a) as well as providing appropriate searching strategies (Craig and Lindsay 2001). It could be hypothesised that such a schema can explain why some individuals discover entrepreneurial opportunities and others do not (Gaglio and Katz 2001). For a conception of entrepreneurial or alert individuals this would mean that entrepreneurs dispose of more effective mental models, which improve their ability to recognise or interpret a given economic setting or problem situation. In other words, it might be hypothesised that individuals with a high ability to recognise entrepreneurial opportunities possess better developed and clearer prototypes of opportunities (Butler and Ensley 2003) or richer scores of exemplars (Baron 2004a).

Figure 32 summarises central cognitive characteristics individuals exhibit and seem to discriminate the entrepreneurial mind from the non-entrepreneurial according to the dimensions that were introduced in chapter III.C.3.

Among other Aspects, Entrepreneurial Minds Mainly seem to Differ in that…

(1) Memory Organisation and Facilitation Skills

- …episodic knowledge is accumulated through personal experiences, often as result of business ownership experience.
- …they include more prior knowledge.
- …they possess richer, that is more complex and better-developed mental frameworks for organising and interpreting information related to a domain.
- …they possess better developed and clearer prototypes of opportunities or richer scores of exemplars.

(2) Specific and General Problem Solving Skills

- …they use heuristics and cognitive-based reasoning more extensively than others.
- …they are subject to many cognitive biases.
- …they apply decision heuristics, instead of executing algorithm-like processes.
- …higher-level learning is executed more often.
- …they dispose of superior veridical perception and interpretation.
- …they search systematically for relevant information in known information channels.

(3) Metacognitive Skills

- …apply off-line evaluation.
- …dispose of superior metacognitive knowledge for overcoming cognitive biases in decision-taking.
- …they raise a higher search investment of successful entrepreneurs for additional information in discovering entrepreneurial opportunities.

(4) Extra-Cognitive and Affective Skills

- …they are characterised by a forward-looking form of intelligence.
- …high involvement of personal beliefs can be found.
- …a promotion focus in self-regulation is dominant.
- …they are optimistic and generally believe that things will turn out better than rational considerations suggest.
- …self-interest and self-competition motive are triggering alertness (selective entrepreneurial attention).

Figure 32 Some Central Characteristics of Entrepreneurial Thinking.

B. Opportunity Recognition as Creative Thinking

1. Preliminary Thoughts

Opportunity recognition in the present work is seen from a decision making-perspective, which leads to the central question how certain economic actors in certain economic situations do mentally conceive new options of action, they expect to yield a profit and, thereby, introduce novelty to markets and economic systems? In answering this question it is not a new idea to turn to cognitive psychology on creative thinking. As indicated by reviewing entrepreneurial cognition research it has been shown that already others have suggested the creative cognitive approach as a general theoretical framework for understanding the thought processes involved, thereby helping in finding measures to increase the ability to recognise entrepreneurial opportunities (Ward 2004). As Baron (2004) puts it, "[…] recognition of opportunities depends, in part, on existing cognitive structures possessed by specific individuals that are the result of previous experience and learning. These structures (e.g., schemas, prototypes, concepts, memories) serve as frameworks or templates that enable specific persons to perceive links between previously unconnected changes, knowledge, or event […]." (Baron 2004a, p. 54)

Although many studies have been already done on the topic, only very few - if any - attempts have been made to develop a general information processing model of opportunity recognition (amongst them Gaglio and Katz 2001; Pech and Cameron 2006).[xxvi] Therefore, one of the main profits the present study promises to yield is to provide a general framework for a cognitive view on opportunity recognition; consequently, the model proposed shortly incorporates many of the highly valuable insights that have been gained on single cognitive processes in previous studies. The main idea consists in bringing together a general model of economic action in time with a general model of human information processing, both principally capable to account for creative outcomes. The contribution to the discipline could be seen in drawing on a rather modern general framework of creative thinking, while other such attempts use outdated models or focus on only one aspect, e.g. one information process.

With this aim, to investigate economic agents' thinking processes, it seems sensible to take a look what literature on human thinking can say about the creation of novelty (see e.g. Gilad 1984; Whiting 1988). Thus, it was searched for models and theories that can be drawn on in investigating what thinking processes underlie the creative activity of the entrepreneur, who introduces novelty and innovation into economic systems. Such a proceeding is based on the fundamental conjecture that "[…] the work of managers, of scientists, of engineers, of lawyers--the work that steers the course of society and its economic and governmental organisations--is largely work of making decisions and solving problems. It is work of choosing issues that require attention, setting goals, finding or designing suitable courses of action, and evaluating and choosing among alternative actions." (Simon et al. 1986, p. 19)

However, it has been shown that each situation, an individual is confronted with, can be regarded as a problem that has to be solved. This can also be applied to economic situations and different kinds of entrepreneurship. Again, this argument underlines the comprehensive view of the present work that in each single opportunity recognition process all the basic information-processes in the model of creative thinking are involved theoretically. Consequently, any human thinking that is done by an economic agent, which might break an existing means-end framework providing a somehow novel option of action, however slight this break might be, is principally regarded as entrepreneurial thinking. Apparently, the logic consequence is that not persons or individuals themselves are this study's primary object, but human cognitive processes that are assumed to be open to any individual.

Hence, the present approach of modelling opportunity recognition as creative thinking stands in the subjectivist tradition; it is seen as a discovery and learning process in the tradition of Popper's theory concerning growth of knowledge (Harper 1999).[xxvii] The reader should be aware of such a constructivist ontological stance's consequences, outlined in chapters II.A.2 and II.A.3. Further, this notion already implies that, if referring to the concept of problem-solving, the present approach is dealing with it in the broader sense and not in the narrower sense as alleged by other scholars (e.g. Shane 2003). Based on this, an entrepreneur is here defined as a person that executes such entrepreneurial thinking, or problem-solving or information processing, to a certain degree, exceeding a certain mark. Consequently, it is a certain kind of information processing that delineates entrepreneurial from non-entrepreneurial individuals; hence, the question might be asked if this is a stable state in time, or if such thinking is only a momentary phenomenon?

Another central point that must be considered is the nexus between an individual and an opportunity. From the cognitive perspective of the present work, a certain economic situation might allow an individual to find a novel problem solution that equal to an entrepreneurial opportunity. However, this is just one specific situation out of an infinite number of situations; exactly the same cognitive processing patterns might not function in another economic situation, in the sense that no novel problem solution can be found by the same individual. In summary, there are three main dimensions to which entrepreneurial information processing differs; it is executed by different (1) individuals with different cognitive styles that are confronted with different (2) situations at different (3) points in time.

Thus, the present approach to model the recognition of entrepreneurial opportunities is based on a general model of human action in time that is able to account for these central dimensions. It has been said that the principle of cognitive creativity leads to an idiosyncratic representation of the external world including the options of action available to an economic agent in a given situation at a given moment in time. If economic action is regarded from such a decision making perspective and the development of a general framework is intended, the concept of entrepreneurship must be integrated. Generally, entrepreneurs are such economic agents that decide to pursue a somehow novel option of action. The thinking processes that lead to such specific options of action might be called opportunity recognition. If the economic agent decides to act upon such, it exploits the entrepreneurial opportunity perceived in such behaviour. Therefore, entrepreneurial opportunities are principally similar to any other action that might be chosen by an economic agent.

This view is quite similar to Kirzner's (1979) general view that economic agents assess each market event or situation and alert or entrepreneurial actors do this relatively superior. Entrepreneurs have a better grip on reality because they can perceive it more accurately and have a superior ability to infer the likely implications and consequences: veridical perception and veridical interpretation (Gaglio and Katz 2001). This means that certain perceptual and interpretational styles enable some individual to discern when the existing way of solving economic problems (services, goods, or the way these are produced or supplied) is not the best available, thus inferring if a situation offers a commercial potential. Vice versa, non-alert individuals fail to identify or create entrepreneurial opportunities since the market environment and the kind of behaviour demanded by the economic situation at that point in time is misjudged (Gaglio and Katz 2001).

However, the explicitly comprehensive approach to entrepreneurial opportunities and their recognition or construction implies that neither only Schumpeterian or Kirznerian entrepreneurship is modelled, but both can be captured. The difference becomes apparent in two aspects: Firstly, in the degree of novelty the thinking process's output exhibits and, secondly, in the different processes' relative importance within the general model. The former point is quite self-explaining since Schumpeterian opportunities are assumed to be more radical and innovative than Kirznerian opportunities. The latter argument is more difficult to explain; basically, in Schumpeterian entrepreneurship the process of category combination and reorganisation seems to be more important than the other information processes involved since this process is seen as actual source for real novel outcome.

In turn, Kirznerian entrepreneurship can be assumed to be based more on the process of category selection. Individuals with a high ability in processing such information are superior in recognising a situation as something actually already known, as being more alert. In such situations, in which stimulus recognition is most important, the process of category selection is most important; individuals activate knowledge or information they have stored, related to what they perceive in a situation. Other processes, like the novelty-producing concept recombination process, are less important probably not even active (i.e., assuming the parameter value of zero in arbitrary entrepreneurial activity).

However, the vast variety of research on entrepreneurial cognition and human thinking outlined in previous chapters seems to impose the necessity to underline some central 'technical' assertions of the present work, in order to model opportunity recognition as information processing. These are assertions or assumptions are not questioned anymore in the following considerations; thus, they somehow resemble to axiomatic principles.

2. Basic Assumptions

For purposes of methodological clarity the mentioned central entrepreneurial processes of opportunity discovery or recognition and exploitation are strictly dissected in the present work. While the former ends with a somehow novel option of action, the latter concludes with the creation of a venture. In the present work it is exclusively dealt with the discovery of such opportunities and not with the decision to select and efforts to realise this option

Assertion: The work only treats the recognition of entrepreneurial opportunities, letting the decision to exploit and the exploitation untouched.

Before discussing what distinguishes the particular type of options that are regarded as entrepreneurial opportunities from non-entrepreneurial ones, it has to be introduced how such options are generally modelled. As pointed out earlier, an option of action is part of a idiosyncratic mental situation or problem-situation that has been developed by the individual at the present point in time in a given situation. It has been said that these internal representations can be generally conceived as a template frame that consists of several slots, in which an economic situation's features and characteristics are stored. The approach alleged here presupposes that an individual's knowledge is reflected in the information applied to these operations (Mumford et al. 1991). This also implies that knowledge is not simply information; rather, information is stored and interpreted in categorical structures, viewed as an organised interrelated set of discrete pieces of information, in which organisation is derived from the central features of the category (Barsalou 1982, 1983). The considerations on categorical knowledge in chapter III.B.2 and III.B.3 should have made clear that other conjectures in this matter are regarded as a matter of course (Barsalou 1982).

There are many ways such systems of slots may be conceived or discussed which must be necessarily included to sufficiently account for different problem situations. However, in the present work it is argued that a general framework based on cognitive literature can best serve for the purposed of investigating opportunity recognition. The main reason standing behind this lies in the ontological stance of the present work. It is principally agreed on the objection that ex-ante predictions about the occurrence of novel outcomes are impossible. However, it is intended to find invariant characteristics of thinking processes leading to such. Therefore, the relevant level of considering representations, i.e. the set of variables included to describe the situation must be as precise as possible, in order to describe economic situations as best as possible, but sufficiently general to account for all possible types including such in which entrepreneurial opportunities occur. This characteristic of generality guarantees that no finite set of states is presupposed that can only be described with these variables, but endogenous novelty is allowed for.

However, the variables considered must still have some explanatory power in describing economic situations. The variables or slots included for the present work have been found significant in humans' attempts to come to problem representations, in particular in coming to creative outcomes. The crucial types of information *TI* that are needed for obtaining a sufficient overview on the situation at hand have been identified in literature on creative thinking and are presented in more detail while discussing the cognitive processes included in the model presented in chapter IV.C.

Generally, a template frame of an economic situation *ES*, as depicted in Figure 33, is assumed to include information concerning the inherent goals TI^G, constraints TI^C, general principles TI^P, action plans TI^A, and factual data TI^I. Each single slot in the frame is filled with different statements or information belonging to the respective type of information. In fact, each slot is therefore described by a set of information; for instance, an individual has a set of goals $TI^G = I_1, I_{2,\ldots,} I_m$ and so forth. It is argued that such frames are capable of sufficiently describing a whole mental situation as demanded by general research on problem representations.

(defineType	EconomicSituation	ES
(supertype	ProblemSituation)	
(Goal	(type statement))	TI^G
(Constraint	(type statement))	TI^C
(GeneralPrinciple	(type statement))	TI^P
(ActionPlans/Options of Action	(type statement))	TI^A
(Information	(type statement))	TI^I

Figure 33 Template Frame of Economic Situation.

Whatever source is used to come to such information, an economic agent is assumed to possess information regarding these types; i.e., having values available for the variables of the situation. It should be apparent that such a frame is part of a huge network of knowledge categories; for instance the goals $TI_j^G = I_1, I_{2,\ldots,} I_m$ could be modelled in a separate frame, for instance distinguishing better an individual's long-term or short-term goals.

Assertion: Knowledge and information about the external world are stored in idiosyncratic conceptual representations of economic agents.

By saying that endogenous creativity is allowed within the model, it has been implicitly made clear that time does matter and is explicitly considered. All sets of possible and included information might change from one point in time to the next. Apparently, creativity in economic thinking is accounted for in the present model by assuming that economic agents are able to alter the possible space of events within its *ES*. However, time as factor does not directly relate to any sequence or length of the cognitive processes introduced hereafter. It is only mentioned to point out that opportunities and their sources are subject to change in time (i.e., there only exist windows of opportunity). Since only few things can be said about the sequence of processing in the human mind, it is assumed that the processes are executed in such a short time that they can be regarded as simultaneous for an economic perspective of the phenomena. Consequently, the factor t only refers to economic situations and larger discrete steps in time, in which the sets of information describing a situation can be genuinely altered.

Assertion: Endogenous creativity is allowed for by altering the set of valid values in the mental representation of an economic situation, implying the necessity to include historical time.

Since it has been shown that information and knowledge are inherently subjective concepts, it is here formally differentiated between different economic agents by denoting them with j, meaning that the population of economic agents is made up by n - information processing systems $EA_{j=1}$, $EA_{j=2}, \ldots EA_{j=n}$. It is no coincidence that this concept resembles to the term of a means-ends framework. In a way a concept of an economic situation is a description that contains ends that are intended to be achieved (goals) or constraints, which are not supposed to happen. The underlying structure or general laws at work of the present situation stored in the slot of general principles determine which actions are principally possible and how factual data incoming is perceived. These actions can be considered as the means to achieve the goals set in the situation. However, it should be noted that such a notion of means-ends-relationships is highly critical since it is of a highly subjective nature as well since constructed by the individual itself (Mitchell et al. 2007).

Although such representations' subjectivity is one of the present work's main arguments, it is nevertheless argued that independent of any subjects different kinds of external situations can be differentiated. For instance, markets an economic agent is acting in can be in relative calmness, while others are in a steady turmoil of change. Alike, no one would seriously doubt that problem representations in different industries say biotechnology or handcraft, are not significantly different across all individuals. Without being more specific at this point since there can be thought of literally myriads of dimensions to which situations differ, a specific type of situation an individual is confronted with is denoted by k. Since each individual is still considered independently, the subjective nature of knowledge and reality is still taken into account, while also the nexus between an opportunity, via the situation or context in the external world, and the individual is included (Mitchell et al. 2007).

So far, it has only been explained how a general representation in economic situations is seen and nothing has been said about what characterises an entrepreneurial opportunity in such a framework and how these differ to other non-entrepreneurial options of action. It has been said that entrepreneurial opportunities can be seen as new means-ends frameworks. This term has to be refined since in Kirzner's sense, allocating scarce resources in order to maximise return is not breaking the prevailing framework (Gaglio and Katz 2001; Kirzner 1985). This has to be seen separated from entrepreneurs that identified new ends to strive for and made new means available. While this would mean in cognitive terms that an extreme or important instance of an existing schema is changed by such individuals (Gaglio and Katz 2001), the present work proposes that each change in an instance of a schema (which equals a recombination or reorganisation) could be principally regarded as opportunity recognition; the degree of change would then determine the opportunity's location on a dichotomy, such as Gaglio's entrepreneurial opportunity scale. This means that a mental alteration of means and ends included in the framework produces a novel combination. Put in more economic terms, it can be said that a new resource combination has been conceived. This new framework must meet the criteria set for entrepreneurial opportunities in chapter II.C.1.

Most generally, an opportunity can be here defined as a desirable future state that is different from the current one and that is deemed feasible to achieve (Stevenson and Jarillo 1990). However, in such a decision-based model the crucial and observable aspect are the actions taken to realise this, implying that an entrepreneurial opportunity's relevant characteristics must evolve in, or through, an option of action available to the economic agent. Consider for instance a simple situation in which an economic agent recognises an opportunity to realise an arbitrage-profit. In such a situation, the respective frame includes information about two different prices for the same product. This information leads, possibly, to the available option of action or action plan that is aimed at exploring this situation: The opportunity is expressed via the action that can be taken.

Assertion: Entrepreneurial opportunities are options of actions within such representations of economic problems.

This central assertion of regarding the cognitive nature of entrepreneurial opportunities directly implies that the mental conception of such options of actions is here seen as central cognitive issue in recognizing entrepreneurial opportunities.

Assertion: Opportunity recognition is the alteration of the current economic situation's representation expressed via a new option of action.

The example of an arbitrageur also serves to point out that in such an individualistic, cognitive approach it is not immediately relevant, whether there has been a change in the external world; that is here prices have changed recently. It might be similarly likely that this price asymmetry has existed long before, but no one has ever made the connection, i.e. recognised the opportunity, before. Put generally, a direct stimulus is not a necessary prerequisite for opportunity recognition. Nevertheless, it could be argued that there is a higher probability to be the first if the situation leading to the opportunity has not existed long before. This highly subjective nature of the mental representation automatically implies that the concept of novelty is of such nature as well since an information perceived to be new, stored in any of the slots of the mental situation by economic agent EA_1, might be already known to other individuals, say EA_2, as has been pointed out by the problem classification of Getzels and Csikszentmihalyi (1976) in chapter III.A.2.

However, considering that a certain degree of novelty is considered as inherent characteristic, concluding, opportunities must exhibit both, novelty and usefulness (Ward 2004). This can be seen analogously to von Weizsäcker's concept of information alleged in chapter II.A.2 that novelty and confirmation both inherently belong to valuable information. Other economic agents, i.e. customers, can only cope with a certain degree of novelty that allows them to understand a new solution as superior to already existing ones. For thinking processes it can be inferred that opportunities must be subjectively logical in hindsight since they are constructed with a logical link back to previous experiences (Yu 2001). For instance, O'Driscoll and Rizzo state that "[…] entrepreneurial success depends on the capacity of seeing things in a way which afterwards proves to be true, even though it cannot be established at the moment." (O'Driscoll and Rizzo 1986, p. 67)

For the present work it will be talked about an entrepreneurial opportunity's originality, which can be understood as the right balance between novelty and familiarity (Ward 2004). Therefore, the individual capability to produce entrepreneurial opportunities that is intended to be explained in the present work can be operationalised by measures of the quality and originality contingent on the cognitive process employed and the way in which existing knowledge is accessed (Ward 2004). Following Mumford et al. (1996), high quality in problem-solving is generally regarded as an appropriate reaction to the problem at hand, with a high probability of leading to a logical and practicable solution. In turn, high originality is considered as an option of action that goes beyond the obvious and given in the situation, likely to lead into an unusual, yet feasible, problem-solution.

Along these lines, a central conjecture of many efforts to investigate creative behaviour is that it is reflected in its outcome, in a novel, socially-valued product (Mumford and Gustafson 1988; Briskman 1980; Busse and Mansfield 1980; Ghiselin 1963; Hocevar 1981). The main implication is that creativity, respectively the ability to produce novel solutions in economic settings, is not a unitary psychological attribute, but rather outcome of a dynamic interplay of individual and situational variables (Amabile 1983; Taylor 1972). Hence, it is assumed that an entrepreneurial opportunity is a solution to a problem, which is recognised by individuals in certain environmental situations that meets the specific criteria and is expressed via an option of action stored in the entrepreneur's mental situation. This outcome-oriented perspective is very important to the methodological proceeding in the present work. Mainly, it allows engaging in analysing causal relationships among different information processes that are linked to the output, i.e. the dependent variable, the opportunity recognised.

Assertion: The capability to recognise entrepreneurial opportunities is reflected in its outcome, in a novel, socially-valued service or good.

This leads to another central conjecture underlying the idea to draw upon a general information processing model of thinking; it is that "[…] opportunities themselves are unique, but the basic processes that play a role in their recognition are the same in all cases." (Baron 2004a, p. 55)

Assertion: Opportunities themselves are unique, but on a sufficiently general level the basic processes that play a role in their recognition are the same in all cases.

Nevertheless, the efficiency and appropriateness of this application of operations may differ among individuals (Sternberg 1986a, 1988a). From a psychological perspective, the present model is situated in the information processing paradigm and creative thinking is conceived as has been outlined. This means, it is assumed that successful problem-solving efforts require information upon which they are based. Working on information as fundament, a process is defined as an "[…] organised set of operations performed on some information set resulting in one or more outcomes required for eventual solution generation" (Mumford et al. 1991, p. 100). This processing is tied with extant categorical knowledge structures, which implies, among other things, that the nature and the quality of creation problem solutions may vary with the kind of information considered in this approach. For instance, the application of declarative knowledge and procedural knowledge may result in significantly different types of rules and creative products (Mumford et al. 1991). It follows that, as has already been mentioned several times, an individual cannot produce something from nothing; i.e. ex nihilo nihil fit (Ward 2004). According to the present model, new understanding providing a basis for novel problem solutions is derived from either the combination or reorganisation of categorical knowledge available; therefore, based on already available knowledge structures.

Assertion: The combination and reorganisation of extant knowledge structures is the central element in recognizing entrepreneurial opportunities.

In fact, the whole model was originally an attempt to merge previous insights of cognitive psychology about several processes that have contributed significantly to the understanding of creative thinking (Mumford and Connelly 1993) with the relevant literature on extant knowledge structures (Mumford et al. 1997). However, more specifically, an individual might generate a novel or new approach to a problem by applying extant categories to a type of problem; or applying them in a different sequence (Mumford 1991). The processes executed to combine or reorganise extant knowledge structure are therefore assumed to be of particular significance in opportunity recognition since it is always linked to a certain degree of novelty.

In addition, three further implications are related to the emphasis of linkages between knowledge and processing in the approach: (1) Firstly, quality and organisation of categorical structure may have a marked impact on creativity. This means that poorly defined or inarticulate categories may well impede an effective application of these processes; vice versa, highly articulated, well-differentiated structures can, thereby, give rise to a curvilinear relationship between expertise and creativity (Simonton 1984). (2) Secondly, information encoding and applied search heuristics to detect relevant information warrant more attention of researchers than so far. And, thirdly, (3) the importance of categorical information structures suggests that particular strategies for organising information seem to be more likely in helping an individual to execute search, construction, and combination processes (Mumford et al. 1991).

This notion allows a general research approach that aims at explaining interactions between information organisation and process operation. This means more specifically that domain-specific, knowledge-based approaches for creative thinking are not necessarily incompatible with process-based models. Instead, they can be seen as interactive systems, such that divergent thinking may represent a domain-specific capacity and a generalisable characteristic of individuals. This central point of the approach can be illustrated by considering some of the ways an understanding of information structures might be used to facilitate the application of cognitive core processes, for instance the combination and reorganisation process. Firstly, novel combinations can be hypothesised to be achieved or facilitated by restrictions prohibiting the application of simple hierarchical combination strategies (Mobley 1990). Secondly, an explicit emphasis is put on the need to incorporate discrepant observations or diverse categories (Kuhn 1970). Thirdly, activation of a typical category example or exemplars of associated multiple categories (Doares 1990).

The encouragement of individuals to consider similarities in goals, constraints, and strategies used in prior problem-solving efforts, as well as content similarities, might possibly facilitate the construction of novel problem constructs and potentially viable new solutions (Reiter-Palmon 1990). In a similar way, events contributing to the application of multiple, extended search strategies might also contribute to the generation of novel problem solutions through more effective application of the category search process. These considerations point to the argument that individuals apply certain decision heuristics or strategies respectively have preferences or styles that guide their information processing and, therefore, have a strong impact on the thinking process' outcome.

This draws the researcher's attention towards an individual's personal style or preferences in processing information. Consequently, it is here assumed that such metacognitive skills or decision rules, guiding process application, are of particular interest in understanding individual differences in the thinking process' outcome. Effective preferences could be stored in the entrepreneurial mind as a knowledge structure, a script, guiding the cognitive processes, which could be called in the context of the present work an effective schema of entrepreneurial alertness or opportunity recognition. There are many ways, how such preferences can differ among individuals; in the present work, the particular characteristics are presented for each cognitive process. However, they are all based on preferences for processing types of information that are included in the frames representing knowledge structures. Consequently, the present work focuses cognitive style and not capacity where possible; it is principally not measured how many information is processed or encoded, or how fast the economic agent is in doing so. It is about his style, about his preferences, expressed through the weights given to particular information in the respective cognitive process.

Further, it is assumed hereafter that the individual preferences dealt with in the present work are of a rather chronic, i.e. stable, nature that can be treated as a kind of personal characteristic of economic agents; this implies terminologically that preferences and styles are treated as synonymously hereafter. This metacognitive aspect has two main implications as well: On the one hand, if an individual's errors in cognitive problem-solving could been detected and analysed along with the location of these errors, it might help in elucidating processing rules and the potential on effective process operation in various domains. On the other hand since an individual's resources are inherently limited, and controlled processing may pose strong resource demands (Ackerman 1986), task motivation may play a crucial role in the effectiveness of process application. Although the role of motivation in thinking processes appears somewhat trivial, it once again shows that aggregation over processes might be risky in terms of overseeing relevant interpersonal differences (Mumford et al. 1991).

Assertion: For a given level of motivation, the individual preferences for certain types of information in information processing, stored in form of rather robust cognitive styles, strongly influence the output of the opportunity recognition process.

An exception is made for the process of category combination and reorganisation; so far, as will be shown in its detailed discussion in chapter IV.C.3, not enough is known about preferences or styles in this process. Thus, it will be drawn on other ways to assess individual differences concerning this cognitive process.

3. Reference Model of Creative Thinking

The main intention of the scholars conceiving this general model was to overcome the qualified criticism on discrete thinking models mentioned in chapter III.C.1 (Mumford et al., 1997b). Nevertheless, it should be kept in mind that these basic processes are a construct to understand a human mind's actions. This particularly implies that they rather represent primary processes on an aggregate level, which are built up by secondary processes. Presenting them this way should not distract from the complex and integrated nature of creative thinking as already pointed out in detail. The model in Figure 34 is supposed to highlight the hypothesised process relationships, which are assumed to be dynamic and cyclical in all complex and creative problem situations.

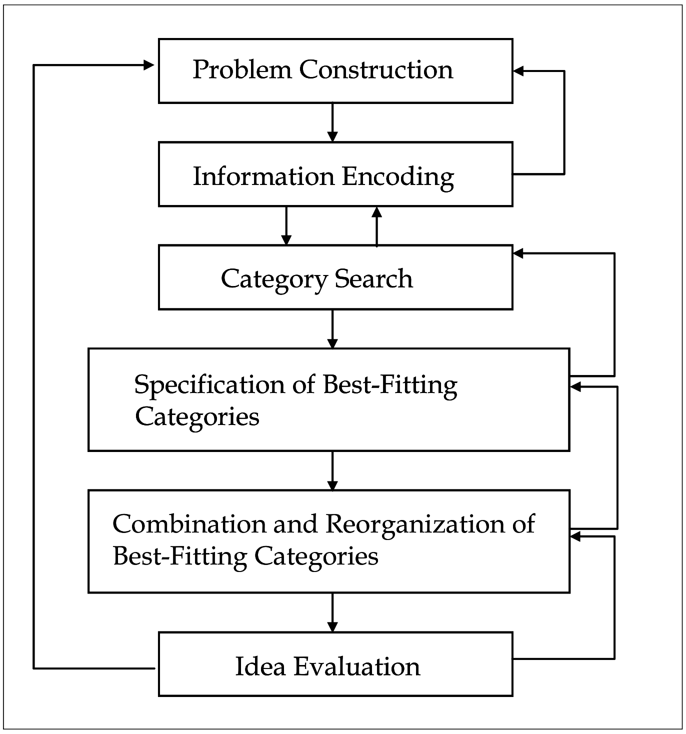

Figure 34 Reference Process Model of Creative Thinking (Mumford et al. 1991).

Basically, the whole thinking process, depicted as a petri net in Figure 35, starts with the initial construction of a tentative problem representation in $t = i$; when stimuli from the external world E hit the human mind of an economic agent EA_n, it tries to makes sense of what is perceived. This initial picture of the external world TR_1 is then updated by encoding additional information; this might be considered as an information search in the external world. This updated problem representation TR_2 is then, in turn, fundament for a search for extant knowledge categories in memory that seem to be relevant for the situation perceived. Once a set of such knowledge categories is activated the next process specifies the best-fitting instances out of these, resulting in another problem representation *PR*. In case of non-creative thinking (*TE~)*, an available option of action *A* is selected from this problem representation.

However, in case (*TE)* the individual executes the process of category combination and reorganisation *(CC)*, the actual production of novelty derives from the combination and reorganisation of these activated and specified knowledge categories that are merged into novel ones, into new ideas or an new problem representation (*NPR)*. Then, another set of options of action might be at the individual's disposal to select an action. The triggering events that induce categorical combination and reorganisation are not well known yet, reason why they are not treated in the present work (Mumford et al., 1997b).

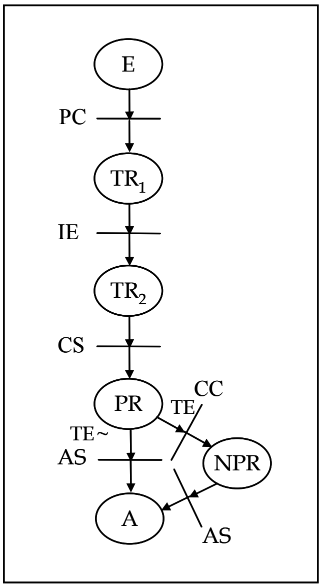

Figure 35 Reference Model of Creative Thinking as Petri Net.

It should be noted that this model of creative thinking highly resembles to the basic model of human action in time; in fact, it seems to allow modelling the principle of cognitive creation: It is represented by the whole thinking process until an individual reached a problem representation or mental situation (*PR* or *NPR*) from which an option of action is chosen. Hence, the sources for novelty can conceptually be found in the perception of the situation (problem construction, information encoding, and category selection) and the mental alteration of means-ends frameworks (category combination and reorganisation), marked brown in Figure 36.

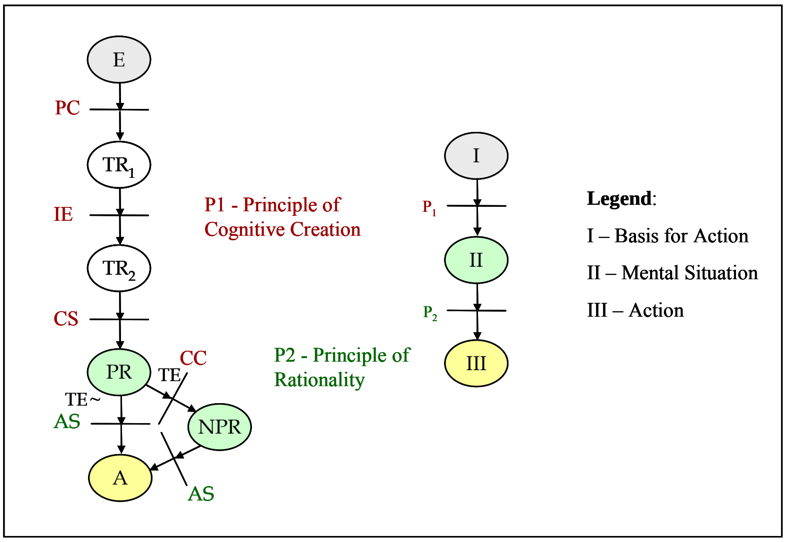

Figure 36 The Principle of Cognitive Creation as Creative Thinking.

The basic processes of problem construction, information encoding, category selection, and category combination and reorganisation and their role in creative thinking were all experimentally surveyed in an extensive study, which underpinned the assertion that they are effective predictors of performance on creative problem-solving tasks (e.g. Mumford et al. 1997a). However, despite their separate treatment in the reference model's detailed analysis, it is commonly accepted in contemporary approaches that there is no predetermined, but rather selective process application, depending on the individual and the situation it is situated in. Given this high interdependency between the information-processes included, the core processes hypothesised to play a role in creative thinking are not introduced in detail before the relationships amongst them are underlined now.

If, at any stage, an unsatisfactory outcome is detected, individuals may return to an earlier stage; to which depends on the nature of the identified deficiency. Given the adoption of the principle of cognitive efficiency, subjects are assumed to cycle back to the previous process (Howe 1982; Koestler 1964; Rothenberg 1986). Considering that individuals have already applied such processes in previous situations, this conjecture also suggests how integration occurs and why certain phenomena arise, for instance the impact of available categorical structures and prior life history in information search (Gruber 1983; Siegler and Richards 1982).

The processes in Figure 36 are sequentially arranged. This implies that a successful application of processes at a later stage is dependent on previous processing efforts. Due to this serial dependency, creative efforts are often difficult and time consuming. Furthermore, relationships may turn out to be hard to track down because of the operation of interviewing steps and mediating mechanisms in the experimental situation (Mumford et al. 1991). Although sequential dependency is given in all situations, this does not mean that the processes are of equal importance in each problem situation. For instance, reconsidering the different problem-solving situations presented in chapter III.A.2, a problem may already be defined, thus, reducing the individual's necessary efforts in the process of problem construction.

In turn, the relative relevance of the processes will vary across problem domains, with creative thought being least difficult if the problem domain emphasises application of the latter processes (Mumford et al. 1991). The relationships in the model also underscore the importance of both convergent and divergent thinking processes (Mumford et al. 1991; Runco 1994) or, only terminologically different, ideation and evaluation (Basadur 1994; Getzels and Smilansky 1983). This is particularly evident in the relationships between category search and specification of best-fitting categories, as well as between category combination and reorganisation and idea evaluation: While the former processes of search and combination are rather divergent, the latter two of specification and evaluation refer to convergent thinking.

Generally, the model presented is highly interactive, complex, and recursive. As emphasised in chapter III.C.2, recent developments in research on human thought and creativity have abandoned the process view that prescribes a fixed number or sequence of discrete steps and strategies that must be applied in a fixed, predetermined sequence (Israeli 1962, 1981; Lubart 2001; Runco 1994). Instead, the process requires the execution of several strategies at different stages (Treffinger et al. 1994). For example, problem solvers might evaluate a problem first and then subsequently evaluate alternative problem representations, tentative solutions, or even probable success of a solution. Thus, a difference exists between evaluations of processes (which is monitoring) and evaluation of solutions.

Further to interactivity, it could be argued that the interactions between operations and skills in creative thinking described above are of a serial dependency and could be seen as dynamic, cyclical interrelationships (Mumford et al. 1991). This notion has been proved by clinical judgements which revealed that complex functions - complex in the sense that they use interaction and exponential terms - were most accurately in describing subjects' judgements. Unfortunately, these equations were highly idiosyncratic so the most predictive model for a specific individual simultaneously possessed the lowest generality (Wiggins 1981). This implies that thinking or creativity models that intend to be of a general character have to find the balance between accuracy and applicability (Runco 1994); this is particularly important to real-life problems (MacKinnon 1962; Okuda et al. 1991). The processes' interactions may not only be complex, but also recursive in a forward and backward manner. In other words, the whole process exhibits numerous feedback loops (Bachelor and Michael 1991; Eindhoven and Vinacke 1952; Mumford et al. 1991; Subotnik and Moore 1988). Some authors suggest the main reason for this might be attributed to the ongoing evaluation of information or knowledge processed (Runco 1994; Jausovec 1994). As illuminating example might serve the sub-process of problem construction that can occur at the beginning of an individual's creative work and recurs in the middle of the whole effort when inconsistencies in the problem representation prevent further progress (Dudek and Cote 1994; Jay and Perkins 1997; Simon 1988). Nevertheless, for methodological purposes it seems to be appropriate to break these processes down into discrete steps and elucidate the rules underlying their application in various domains (see for instance Baer 1988).

The assumption that there is not a predetermined, but rather selective process application has further implications. First and foremost, it once again underlines that there exists a need to attend to decision heuristics. If there is no predetermined sequence of processes, an individual must apply certain rules for allocating its limited information processing resources; the importance in creative thinking is shown by findings on satisfycing strategies (Cyert and March 1963; Nutt 1984), the influence of instructions (Harrington 1980), and the potential impact of premature convergence (Basadur et al. 1990).

Such cognitive styles in information processing are now presented in the context of opportunity recognition. The treatment starts with the construction of the initial problem representation in part 1 of this chapter’s last section. Then, this mental model is updated by searching for information in the external world and activating relevant knowledge categories in memory. These processes are dealt with in the second part, followed by the third, concerned with the combination and reorganisation of activated representations and their evaluation. To begin with, each of the five processes and corresponding cognitive styles considered in the present study are introduced generally and then put into the entrepreneurial context. Each treatment includes the hypotheses to be studied empirically and ends with some remarks concerning formal issues for the present study. It should be noted that the selection of cognitive styles included in the study was based on the literature review of creative thinking and opportunity recognition as outlined before.

C. Cognitive Processes and Styles in Opportunity Recognition

1. The Initial Problem Representation

Apparently, the process of problem construction is related to the cognitive operations dedicated to find an initial problem representation. The efforts are all aimed at defining the aspects of a problem representation in ill-defined domains, where a complete problem definition is not given. This first ‘sense-making’ or ‘impression’ of the situation is assumed to have a high influence on all subsequent processes since it sets the initial cognitive framework. The efforts necessary and the complexity of the task vary with the degree of prior structuring (Dillon 1982). Thus, the more novel and ill-defined the economic problem situation is, the more is the initial problem representation formed by ad-hoc categories, using outcomes of prior problem-solving efforts; they seem to be of particular importance in real-world settings since there can be found a minimised level of a-priori structure (Okuda et al. 1991).

However, from a researcher's perspective it is difficult to specify rules and operations which are employed, given the subjective or idiosyncratic nature of such processes (Csikszentmihalyi 1988) and the question must be asked how individuals go about constructing problems (Moore and Murdock 1991). Therefore, it must be referred to certain hypotheses for which empirical results exist.

For instance, Gick and Holyoak (1980, 1983) found in a series of studies that subjects provided with an example of how to structure and solve a problem in a certain context (in these studies a military problem) used elements from this task to structure and solve a task in a totally different setting (in Duncker's (1945) cancer irradiation problem). Based on these findings, it could be assumed that individuals in novel, ill-defined problem situations form ad-hoc categories, using outcomes of prior problem-solving efforts (Holyoak 1984). More formally, the present work assumes that contextual stimuli in the external world trigger certain problem schemas that will be screened by the individual in order to identify commonalities in relevant features. At this point, one is facing the classical problem in psychology of defining the effective stimulus. A subjectivist approach should however underline that the triggering event for certain thinking processes must not be necessarily lie in the external world directly; further, a significant time lag can lie between perception of an external event, as stimuli, and the internal interpretation as unexpected prompting subsequent thinking processes (Gaglio 2004).

However, this fundamental question will be omitted totally and attention direct towards active rules and operations employed. In the present conception of problem construction, shown in Figure 37, it is assumed that an event is perceived and attention directed towards several cues of this event. These cues activate a set of extant problem representations (1). The less of this information he gets from the external world by perceiving the situation, the more he has to fill in by extant knowledge structures he already possesses from prior economic situations, he has been confronted with (one reason why expertise plays a role, more appropriate extant economic problems faced to make sense of this situation).

Each of these knowledge structures reflects an integrated set of representational elements about (a) initial goals, (b) actions, (c) salient information, and (d) significant constraints; i.e. several slots in these representations are filled with these types of information. Then, these representations are screened, in order to identify commonalities in the relevant features, and elements selected and reorganized according to diverse strategies and criteria (2). It is assumed hereafter that the most highly activated schemas from the set of available knowledge categories in an economic agent's mind provide a basis for problem definition, resulting in an initial problem representation (3). Indeed, many scholars in cognitive literature argue that individuals have indeed different styles or preferences directed by chronic schemas for processing information, approaching a task, or making sense of a situation.

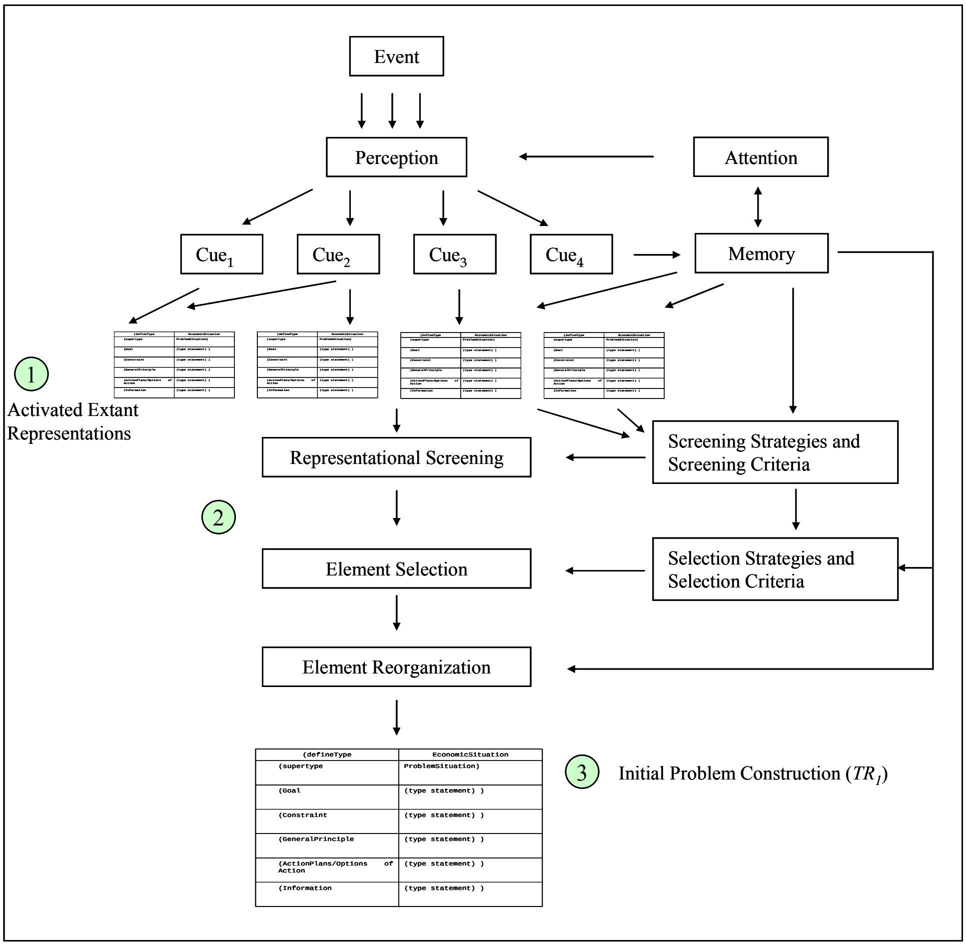

Figure 37 Process Model of Problem Construction.

One of such strategic concepts is called self-regulation (Crowe and Higgins 1997; Higgins 2000; Werth 2004). It is based on the hedonistic principle that individuals approach pleasure and that the avoid pain; however, this can be achieved by pursuing the intention to move towards desired end-states or the intention to move away from undesired end-states (Higgins 2000). These two fundamentally different approaches to a situation are assumed to be manifested in two different styles of self-regulation, promotion- and prevention-style that differ along several dimensions (Higgins 1998; Higgins and Silverman 1998): the underlying motives individuals are trying to satisfy, the nature of the goals or standards they are trying to attain, the types of outcomes that are salient to individuals (Brockner et al. 2004), and the means undertaken to achieve this (Higgins 2000).

In this concept, promotion-focus agents are motivated by trying to bring themselves into alignment with their goals or aspirations, i.e., are concerned with advancement, growth, and accomplishment; reason why it is also called an accomplishment orientation. In turn, prevention-focussed individuals tend to focus on security, safety, and responsibility in order to avoid negative outcomes; thus, also called responsibility orientation (Brockner et al. 2004). Such motivational preferences are assumed to be developed in early childhood, largely influenced by the parents' regulative style, either developing strong ideals in a promotion style and strong oughts in a prevention style (Higgins 2000; Witkin and Goodenough 1981). Derived from this fundamental motives in a promotion style individuals aim at achieving a self-congruency to ideals and discrepancies to these are regarded as negative outcome of a decision or action; consequently, an emphasis is put on ensuring the presence of positive outcomes and ensuring against the absence of positive outcomes; hopes, wishes, and aspirations represent maximal goals which are pursuit. In turn, individuals in a prevention style set minimal goals that are considered as duties, obligations or responsibilities that must be attained. Self-congruencies to oughts, then, represent the absence of negative outcomes and discrepancies the presence of negative outcomes (Higgins 1998, 2000). In the present concept of problem construction these different styles become manifest in preferences for goals in a promotion focus, respectively constraints in a prevention focus.

However, regulatory focus theory generally also distinguishes between different means in pursuing goals: there exist eagerness means and vigilance means. While the former term refers to actions that involve ensuring hits and against errors of omission called misses, the latter term, in turn, involves ensuring correct rejections and against errors of commission called false alarms. This implies that a promotion style involves more risky behaviour than a prevention style, which is assumed to be more risk-avers in actions taken (Friedman and Förster 2001). Further, it is postulated that a promotion focus naturally fits to the use of eagerness means, while a prevention focus, similarly, fits to the use of vigilance means (Crowe and Higgins 1997; Higgins 1998, 2000).

The general idea of regulatory focus theory might be illuminated by a simple example given by Higgins (2000): Consider a group of students in a course all working to attain the best grade possible, say A; some of them are oriented towards this grade as an accomplishment, whereas others as a responsibility. Assuming another perspective on the same group of student, some of them might read extra material beyond what was assigned by the lecturer, whereas others are careful in fulfilling all course requirements. While the former differentiation refers to the dimension of regulatory orientation, the latter to the means used to pursuit goals: however, for these two dimensions exists a so called regulatory fit: for instance, reading additional material fits an accomplishment orientation better than a responsibility orientation, while for fulfilling course requirements the opposite argumentation can be made (Higgins 2000). The main differences between promotion and prevention style are summarised in Figure 38, which is also supposed to express that the two styles in their 'pure' form represent endpoints of a dichotomy on which each individual's regulatory focus can be located.

	Promotion Style ⟷	**Prevention Style**
Underlying Motives	Advancement, Growth, and Accomplishment	Security, safety, and responsibility
Goals or Standards	Maximal Goals: Hopes, Wishes, and Ideals	Minimal Goals: Duties, Obligations
Salient Outcomes	Attaining Hits and Avoiding Misses	Attaining Correct Rejections and avoiding False Alarms
Means	Eagerness Means	Vigilance Means

Figure 38 Regulatory Focus Theory: Promotion vs. Prevention Style.

As said before, such a focus guides the initial constructing of a situation in a rather implicit and chronic manner, but might be adjusted by individuals to specific situations. In order to account for these differences, complementary self-regulatory constructs have been developed: for instance, it could be differentiated between regulatory pride and self-efficacy (Bryant 2007).

While the term of regulatory pride refers to the chronic form of an individual's regulatory focus as has been outlined before, self-efficacy describes an individual's belief in its ability to be efficacious in certain task domains (Bandura 1997). Thus, it does not target on strategic goals and they way they can be achieved, but rather on an individual's level of confidence and commitment to pursue such goals (Bryant 2007). Apparently, the concepts are related to each other and research suggests that strong promotion pride is typically accompanied by high self-esteem and optimism (Grant and Higgins 2003). However, in the following, staying at a more general level leaned on preferences for goals or constraints and, hence, the concept of regulatory pride, it will be simply referred to as an individual's regulatory focus.

Nevertheless, studies have revealed possibilities to influence such preferences. Manipulations in context, which might be called framing, can induce the activation of either promotion or prevention focus independent of an individual's chronic regulatory focus (Brendl et al. 1995; Crowe and Higgins 1997). Thus, it can be argued that contextual aspects do not only influence the development of chronic schema but also play a role in which schemas become activated in a particular situation (Corbett and Hmieleski 2007).

Regarding its role in creative thinking, intuition suggests that a situation’s initial representations are quite idiosyncratic in ill-defined problem situations, given the incredible number of possibilities in such unstructured settings (Mumford et al. 1991). This postulate is supported by experimental findings suggesting that the type of representational elements preferred by individuals in structuring novel ill-defined problem situations contributes to the problem-solving efforts’ creative outcome (Mumford et al. 1996a). In particular promotion-focussed individuals seem to be more creative than prevention-focussed people (Friedman and Forster 2001). This corresponds to assertions made in research on entrepreneurial cognition suggesting that a promotion focus enhances entrepreneurial behaviour opposed to a prevention focus (see chapter IV.A.2). Accordingly, in recognising entrepreneurial opportunities it might be argued that individuals showing a promotion-focus have an advantage for doing so because they are more inventive by generating more alternatives for making sense of incoming information and are more open to change than prevention-focussed economic agents (Brockner et al. 2004; Crowe and Higgins 1997). Irrespective of any qualitative aspects, individuals in different regulatory focus styles should exhibit a different approach to opportunity recognition. While economic agents in a promotion style could be assumed to recognise true opportunities, which equal to hits, and avoid failing to recognise such, economic agents in a prevention style aim at recognising an opportunity as false and to avoid recognising an opportunity as true, which is actually false (Corbett and Hmieleski 2007).

Since it is a facet model the question is also asked, which further variables could be hypothesised to influence the creative outcome of this process? A variety of other aspects could be considered to play a role in this matter. As to the individual values could be mentioned, expressed by the salience of various goals or the individual’s knowledge, skills, and abilities that have an influence through the available set of problem representations (Howe 1982). Regarding relevant context variables it is surely significant, how much resources are available to the individual for processing efforts in problem construction. This explains a certain degree of importance of time and attentional variables. Furthermore, other contextual aspects might be the salience of cues indicating desirability of certain goals, the importance of particular constraints, the degree of acceptable risk or the nature of other currently activated categorical structures (Mumford et al. 1991).

Concerning its role in entrepreneurship, initial problem formulation is often mentioned as a very important factor in innovative activity since economic actors or potential entrepreneurs often face complex and ill-defined problem situations, which have to be subjectively perceived and represented before they can be solved (Ward 2004). How important it practically is, how a problem-situation is approached right from the beginning might become quite clear in an illuminating example given by Ward (2004), referring to Barker (1993). In the mid-1970s, Sony nearly missed an important and valuable opportunity since they stopped working on developing music CDs. The reason behind was that they took the format of vinyl LP record albums, which is 12 inch diameter circles, and realised that their new CDs could carry 18 hours of music. In a first instance, it was judged to be too much music before they came up with the idea to produce smaller discs.

This is a good example for initial assumptions made in solving a problem that were taken as given (here the size of the disc), which significantly influenced subsequent efforts. Once the limitation or restriction of size was removed, different and more feasible solutions were available; i.e. the CD in its present form was developed (Ward 2004). Putting this example in general terms, two kinds of constraints in economic settings could be distinguished: Besides external constraints for finding solutions or developing entrepreneurial opportunities (for instance, technological requirements or market and consumer demands), also internal, cognitive constraints exist related to categorical knowledge's structure and the way it is accessed.

Like in the Sony-example it leads to the tendency that individuals base new ideas on specific instances of a given category (such as size of CD). Particularly instances of more general concepts - that is higher-level ones in hierarchical knowledge structures - seem do dominate subordinate instances since most individuals appear to conceptualise a given object on more general concepts (Ward 2004). In a more formal manner this has been developed in the path-of-least-resistance model by Ward and colleagues (Ward 1994, 1995). It assumes that individuals approaching the task of developing a new idea for a particular domain tend to retrieve rather basic level instances from that domain. Based on these, they select one or more of retrieved instances as starting point for their own ideas. Many of the stored properties of those retrieved instances are then projected onto the new idea they are working on. In this case it is very likely that the new idea or creation, i.e. the entrepreneurial opportunity, strongly resembles the old exemplar (Ward 2004).

However, as already touched in discussion the general nature of information, it is often difficult to find the right balance between novelty and familiarity since extant knowledge plays a paradoxical role (Ward 2004). An opportunity must be novel enough to be superior to existing solutions, but simultaneously familiar in order to be accepted by external requirements of the market (e.g. technology features) and internal, cognitive requirements of the consumers to be accepted. This resembles to the cognitive aspect of paths or trajectories often discussed in literature on innovation and institutional economics, for instance in the context of routines (e.g. Lundvall 1992). It is argued that since these routines and learning processes are rooted in the current economic structure, innovation and new ideas are similarly based in such a prevailing setting (Hodgson 1988). It follows that innovations are mostly gradual and cumulative (Lundvall 1992; Muller 2001).

In summary, it is hypothesised here that an individual's focus on types of representational elements included in the initial problem representation influences the outcome of the thinking process. Research has indicated that such representations typically include four main types of representational elements as to how a problematic situation has to be approached: (1) initial goals, (2) actions, (3) salient information, and (4) significant constraints. Consequently, it could be stated that the preferences for applying representational elements about initial goals TI^G, actions TI^P, salient information TI^I, or significant constraints TI^C in problem construction of an agent *j* in situation *k* might be significantly correlated with the quality and originality of the options of action in the final problem representation *PR*.

Each of the sets of representational elements available to an economic actor in an economic situation at a point in time could be defined by the set of information of this type in this particular situation (e.g. $TI^C_{t,j.k} = \left(I^{C1}_{t,j,k}, I^{C2}_{t,j,k}, ..., I^{C3}_{t,j,k}\right)$).[xxviii] However, the following term is supposed to describe the relative importance of each type of representational element; $PC_{t,j,k}$ could be therefore interpreted as the preference structure for types of information of agent *j* in situation *k* in *t*.

$$PC_{t,j,k} = g^{PC}_{t,j,k} \cdot TI^{G} + a^{PC}_{t,j,k} \cdot TI^{A} + i^{PC}_{t,j,k} \cdot TI^{I} + c^{PC}_{t,j,k} \cdot TI^{C} .$$

with: $g^{PC}_{t,j,k} =$ Preference for goals in problem construction

$a^{PC}_{t,j,k} =$ Preference for actions in problem construction

$i^{PC}_{t,j,k} =$ Preference for salient information in problem construction

$c^{PC}_{t,j,k} =$ Preference for constraints/restrictions in problem construction

The term above is supposed to highlight that the initial economic problem representation is built up by representational elements of four different types. The factors g^{PC}, a^{PC}, i^{PC} to c^{PC} sum up to one and shall express the significance of each type of representational elements for this economic agent in this economic situation.

Altogether, these results and considerations suggest the following four hypotheses concerning regulatory focus styles:

H_1: A promotion style of regulatory focus facilitates the recognition of entrepreneurial opportunities.

H_2: A prevention style of regulatory focus inhibits the recognition of entrepreneurial opportunities.

H_3: An action style in constructing problems facilitates the recognition of entrepreneurial opportunities.

H_4: An information style in constructing problems facilitates the recognition of entrepreneurial opportunities.

However, it should be noticed that most likely, the initial understandings of the problem situation provided by the problem construction process in novel-ill-defined problem situations are not sufficient for subsequent problem-solving efforts and are used in a flexible and dynamic way (Novick 1990; Reeves and Weisburg 1994).

2. Updating by Information Encoding and Category Activation

Rather the problem construction will - in a rather preliminary manner - serve as a kind of guideline for the retrieval of pertinent information from long-term memory and new, apparently necessary information in subsequent processes (Amabile 1983; Mobley et al. 1992; Sternberg 1986a, b); this subsequent updating of the initial problem construction (1) is depicted in Figure 39. It is hypothesized that the individual searches the external world for additional information of different types (2). Based on this updated new mental model of the world (3), extant categories are searched for in long-term memory (4). From this kind of long list, those best fitting are specified (5) and reorganised into another version of the problem representation (6). These processes and cognitive styles possibly active are now discussed in some more detail.

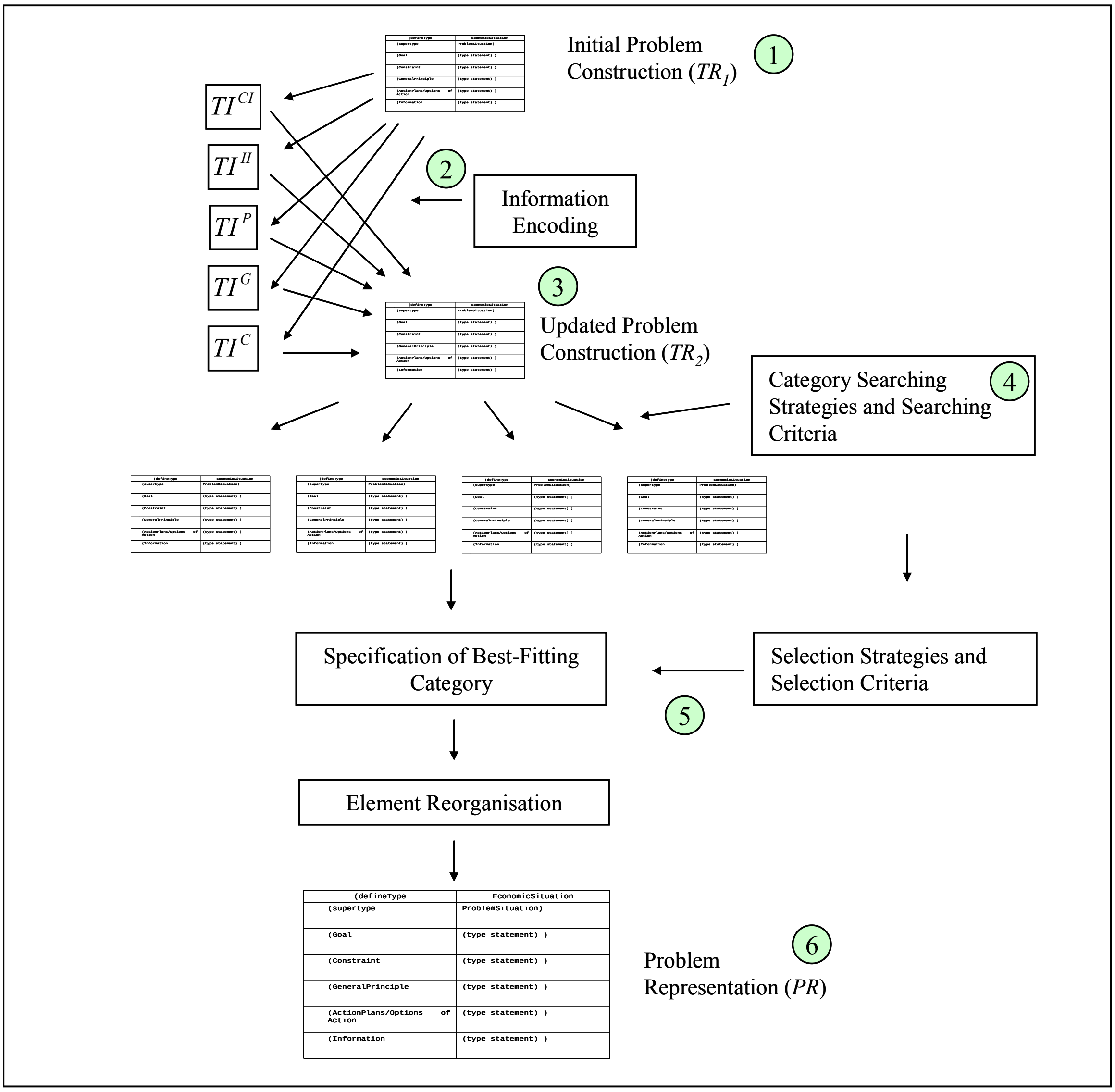

Figure 39 Information Encoding, Category Search, and Category Selection.

Individuals cannot solve complex, novel problems without considering pertinent information; thus, giving reason to regard information encoding as important in creative thinking (Mumford et al. 1996b). Indeed, empirical evidence suggests that novel or/and creative responses are induced by appropriate information search and application (Weisberg 1988). In the present model the conjecture is made that the process of information encoding is strongly influenced by activated extant procedural and declarative knowledge structures that guide information search and retrieval, where activation is engendered by prior problem construction, associative networks, and stimulus cues (Norman 1980; Reif and Heller 1982). In case new information or new knowledge structures have to be acquired, information encoding is assumed to be prolonged and will involve intense, active processing drawing out elaborations and implications of this knowledge (Schmeck and Grove 1979; Snow and Lohman 1984; Thompson 1985). Therefore, according to the present terminology it could be stated that after a tentative representation $TR^{1}_{t,j,k}$ has been built about the situation or problem an individual is confronted with, it then searches for information in the external world in order to update and improve the initial representation leading to an updated representation $TR^{2}_{t,j,k}$. It is assumed that this search for information to be included in $TR^{2}_{t,j,k}$ is strongly based on $TR^{1}_{t,j,k}$.

The first to explicitly show the impact of effective information encoding on problem-solving and creativity was Sternberg (1986a). In this matter, a huge amount of studies exist that focus on information retrieval from long-term memory, i.e. category search (Siegler and Richards 1982). On the contrary, rather scanty knowledge is available as to the acquisition of new knowledge; even though studies were able to show that creative achievement may be generally related to information encoding and the associated search strategies (Perkins 1992) and, more specifically, may be related to the use of systematic and more extensive search strategies during information encoding (Kulkarni and Simon 1988; Qin and Simon 1990). However, if systematic or not, individuals starting to work on creative problems seem to differ according to the kind of information they look for and the search strategies they apply to acquire this information (Perkins 1992; Sternberg 1986b); in other words, individuals selectively encode information. A study of Davidson and Sternberg (1984) provides evidence for the importance of such selective encoding in creative problem-solving since they found out that creative individuals seem to be adept at identifying key relevant facts and tend to ignore irrelevant, distracting information (see also Davidson 1995). Further empirical evidence suggests that individuals display some general strategic differences in the type of information they encode and search for in case they are confronted with novel problem situations: More interestingly, such studies indicate that these preferences have an influence on the creative outcome of the process (Mumford et al. 1996b; see also Mumford and Gustafson 1988; Qin and Simon 1990; Sternberg 1988a; Sternberg and Lubart 1991).

This assertion is also made in the entrepreneurship literature: It is argued that this process, and that of category search, is particularly crucial since economic situations are mostly ambiguous or information is incomplete (Alvarez 2005; Pendergast 2003); it is therefore often mentioned that the search for information plays a crucial role in the opportunity recognition process (Fiet et al. 2000). Further it is suggested that opportunities are recognised resulting of an individuals efforts to search for information cues and questioning what others do not recognise. Information the entrepreneurial mind searches for is than processed in a meaningful manner, leading to the discovery of entrepreneurial opportunities (Pech and Cameron 2006). In this context, Ucbasaran (2004) states that "[…] entrepreneurial cognitive processes can enable an individual to build on specific information to make new leaps in the identification of opportunities." (Ucbasaran 2004, p. 85) This is exactly what the present cognitive model of creative thinking aims at describing: The crucial process of recombination of knowledge structures is closely linked - among others - to an individual's information encoding efforts.

However, the question what information entrepreneurial minds look for and how they search for it, can hardly been answered. Neoclassical economics' information search theory and Kirznerian unintentional search have both only limited value in this regard: Scholars subscribing to the latter criticise the former for advocating a mechanical optimisation process that arbitrarily constrains thinking, whereas followers of the neoclassical approach criticise the latter for having nothing practical to teach to entrepreneurs (Fiet et al. 2000). Another way might be the one presented here, assuming a cognitive view on how entrepreneurs search information based on their prior knowledge, which seems to promise more pedagogical value (Fiet et al. 2000, 2004b). Many of such research efforts on information search behaviour focussed on the source of the business idea (Long and Graham 1988; Peterson 1988), on serendipity or deliberate search (Koller 1988; Peterson 1988), or on search strategies and the amount of search effort (Busenitz 1996; Gilad et al. 1988; Kaish and Gilad 1991). Again others aimed at shedding light on the amount and the type of information, which a potential entrepreneur searches, depending on the extent to which it relies on entrepreneurial cognitive processes and the level of episodic knowledge (Kaish and Gilad 1991; Long and McMullan 1984).

However, along these lines it could be assumed that individuals differ regarding the quantity and quality of information they need to make a given discovery of an entrepreneurial opportunity (Ucbasaran 2004). The detailed study on information search behaviour of new venture founders by Kaish and Gilad (1991) has only weakly suggested that entrepreneurs spend more time on searching for information, but, more important to the present work, that they use certain unconventional sources of information. These findings comply with those on general creative thinking and the principal philosophical view of the present work: It seems rather important which kind of information is attended to by entrepreneurial individuals and which sources are used to acquire such. Indeed, studies suggest that entrepreneurs pay more attention to other cues in a given situation than non-entrepreneurs (Kaish and Gilad 1991).

The close linkage between information processing and knowledge structures, emphasised repeatedly, already suggests that information encoding behaviour is influenced by an individual's idiosyncratic level and nature knowledge. Findings by Cooper et al. (1995) indicate that inexperienced, novice entrepreneurs generally search for more information than experienced, habitual entrepreneurs. This corresponds to the point made by Fiet et al. (2000) that habitual entrepreneurs do not engage in extensive search, but rather concentrate on searching within a more specific domain, which they know well (see also McGrath and MacMillan 2000). It could be hypothesised that a habitual entrepreneur's episodic knowledge superiorly directs attention, expectations, and interpretations of market stimuli (Gaglio 1997); a statement that leads back to an individual's cognitive style in information encoding:

Even though, it is not clear whether individuals display stable strategic preferences in information search and encoding (Mumford et al. 1996b), it is assumed here that specific strategic preferences in form of cognitive styles can contribute to creative performance; but how they could look like? Concerning this issue, studies on scientific work might offer some potential answers: Kuhn (1970) revealed that creative achievement in sciences was often based on the identification of discrepant information and a subsequent attempt to resolve this discrepancy. Similarly, Dunbar (1995) found that a focus on discrepant information and information inconsistent with initial expectations is related to creative performance in microbiology laboratories. Such inconsistencies might encourage individuals to identify and use multiple alternative concepts, thus enhancing upcoming combination and reorganisation efforts (Baughman and Mumford 1995).

H_5: The preference for searching for additional factual information that was inconsistent with the initial factual data facilitates the recognition of entrepreneurial opportunities.

Another fruitful strategy might consist in attending to a wider range of information, independent of the fact if some information might appear apparently irrelevant in the first instance (Alissa 1972). This is consistent with the notion that extended search, that means in this context producing a wider range of information available for upcoming combination and reorganisation processes, may significantly contribute to creative thinking (Finke et al. 1992; Mumford and Gustafson 1988; Perkins 1992).

H_6: The preference for searching for information irrelevant to the problem facilitates the recognition of entrepreneurial opportunities.

Furthermore, the application of the appropriate information search strategies in a problem-situation seems to be positively correlated with expertise (Sweller 1989). More specifically, it appears that experience facilitates rapid and accurate encoding of relevant information through the principle-based knowledge structures that arise in building expertise (Halff et al. 1986). Such rather convergent search strategies are of importance in this regard since information must be organised and placed in a broader context, particularly in complex and novel problem situations (Mumford et al. 1996b). Broadly speaking, experts dispose of more extensive and diverse knowledge structures, organise information into categorical systems based on underlying principles, and have more efficient strategies for organising information in memory via chunking (Chi et al. 1982, 1987; De Groot 1960; Medin 1989). Therefore, the rather convergent effort to search for information bearing on relevant principles might as well be positively contribute to creative achievement (Perkins 1995).

Being more precise about why it seems that accessing domain information at more abstract levels, i.e. accessing underlying principles, leads to more original products may lie in the nature of the stored information. Information stored about a specific instance is by definition more specific and therefore may be more constraining than more abstract information concerning the same types of properties (Ward 2004). Put differently, experts search for such information that facilitates the appropriate subsequent information processing in a general manner. Additionally, expertise seems to have rather subtle effects on the efficacy of information acquisition and solution monitoring (Siegler and Richards 1982). Again, it is also important to distinguish between general and domain-specific knowledge. Theoretically, the latter is important in gaining creative results through the identification of discrepant facts and the subsequent reorganisation of extant knowledge structures to take them into account (Koestler 1964; Kuhn 1970; Mumford and Gustafson 1988).

H_7: The preference for searching for information regarding underlying principles that might be useful in solving the problem facilitates the recognition of entrepreneurial opportunities.

Following a similar argumentation, the attention to search cues regarding goals and restrictions might have an influence on the output of the thinking process as well. It has been said that focussing on relevant principles can reduce complexity in searching for relevant information in the external world. Directing attention towards goals or restrictions might be another strategy to limit the space to search information in (Isaak and Just 1995). Again, it can be assumed that a regulatory focus of prevention- or prevention-style guides an individual's information search (de Lange and van Knippenberg 2007), as has been outlined for the process of problem construction. The overall process model in Figure 34 already indicated by the arrows on the right-hand side between problem construction and information encoding that these two processes are highly intertwined. Therefore, it is assumed that individuals who have a preference on goals in problem construction also have a preference for this type of information in searching for information; analogue, this applies to restrictions or constraints.

H: The preference for searching for information regarding goals that need to be addressed in solving the problem facilitates the recognition of entrepreneurial opportunities.

H: 'The preference for searching for information regarding restrictions or constraints that have to be posed on the problem solution facilitates the recognition of entrepreneurial opportunities.

Nevertheless, these hypotheses are not tested directly since, as will be outlined later, the preferences for goals and constraints in problem construction and information encoding will be treated as indicator for the constructs of problem and prevention style of regulatory focus.

In order to investigate if the search for different types of information has an impact on the outcome of the opportunity recognition process, a sample is drawn in which the individuals are assumed to have more or less similar knowledge about entrepreneurship and the domain, which the economic situation will be set in. The experimental control of this aspect - or these variables - allows making some statements on the cognitive process of information encoding itself, independent of relevant knowledge structures guiding it. However, integrating this into the general thinking model, it can be said that based on $TR^1_{t,j,k}$ the economic agent engages in search efforts that are aimed at finding additional information in the external world that improve the quality or accuracy of the initial problem representation; i.e. allow an update of the initial representation resulting in $TR^2_{t,j,k}$. This process of knowledge acquisition is guided by information search strategies an economic agent applies in a given economic situation.

However, economic agents are assumed to differ according to the kind of information they look for and the search strategies they apply to acquire this information. More importantly, these general information-search strategic differences in the type of information they encode and search for in case they are confronted with novel economic problem situations might that have an influence on the outcome of the opportunity recognition process. It has been outlined that research on creative thinking in other domains suggests that creative economic agents mainly concentrate their search on information for filling the slots of either (1) factual information inconsistent or contradictory with the initial factual data in the problem representation *(TI^{CI})*, (2) information that seems to be irrelevant to the problem situation *(TI^{II})*, (3) underlying principles assumed to drive this particular economic situation *(TI^{P})*, (4) goals to be addressed in that economic situation *(TI^{G})*, or (5) restrictions or constraints posed on the problem solution *(TI^{C})*.

This does not mean that economic agents are presumed to exclusively concentrate on one of these categories in searching information. In fact, they might have a preference for searching for all these information, or for some more than others. Again, these preferences of agent j in situation k at this point in time t are expressed by factors ci^{IS} to c^{IS}. Thus, the preference structure for acquiring additional information $AI_{t,j,k}$ in the information search and encoding process could be described as a set consisting of information of the types mentioned above:

$$AI_{t,j,k} = ci^{IS}_{t,j,k} \cdot TI^{CI} + ii^{IS}_{t,j,k} \cdot TI^{II} + p^{IS}_{t,j,k} \cdot TI^{P} + g^{IS}_{t,j,k} \cdot TI^{G} + c^{IS}_{t,j,k} \cdot TI^{C} .$$

with:

$ci^{IS}_{t,j,k} =$	Preference for contradictory information in information search.
$ii^{IS}_{t,j,k} =$	Preference for information hypothesised to be in information search.
$p^{IS}_{t,j,k} =$	Preference for underlying principles in information search.
$g^{IS}_{t,j,k} =$	Preference for goals in information search.
$c^{IS}_{t,j,k} =$	Preference for constraints/restrictions in information search.

It has been emphasised several times in rather general terms that information processing is schema-driven (e.g. Jackson and Dutton 1988); this will be specified in some more detail, while discussing the two cognitive processes of category search and identifying the best-fitting category: Once the individual has encoded some information it considers relevant to the problem at hand and holds an updated tentative representation TR_2, it continues to make sense of this new context by selecting a set of categories or concepts that serve to organise available information and provide a basis for upcoming efforts, in particular combination and reorganisation (Hayek 1967; Mumford et al. 1996c). This process is called the search for categories, containing the specification of relevant schema or knowledge structures for understanding factual information pertinent to the problem (acquired during the information encoding process), as well as rules for applying, i.e. acquiring, organising, and retaining, this information (Siegler and Richards 1982). In other words, the individual defines a set of categories that will allow pertinent procedural and declarative information to be organised and interpreted (Mumford et al. 1991). This aspect of creative thinking is directly linked to an individual's ability to organise and facilitate its memory. The importance of category search for creative outcomes has been shown in numerous older studies (Alissa 1972; Gough 1976; Harrington 1980; Kogan et al. 1980; Mednick and Mednick 1967; Poze 1983; Runco 1986) and even more recently (Carlson and Gorman 1992; Ippolito and Tweney 1995; Mumford et al. 1996c).

However, for the present study it is crucial to know, which categories or concepts individuals should retain in order to generate useful, new ideas? Are there actually certain types of categories that are - in a particular situation - related to an individual's ability to acquire and organise information and combine and reorganise it later on (Mumford et al. 1996c)? A variety of mechanisms can be presumed to guide category search. Martinsen (1993) showed for instance that conceptual knowledge available to an individual might have a strong impact on creative thinking in that it limits the search for alternative problem-solutions. More specifically, research indicates that experts tend to use concepts based on underlying principles. Consequently, it might be argued that the tendency to select such knowledge structures might increase the probability of a creative outcome of the thinking process (Mumford et al. 1996c); this seems to particularly apply if these underlying principles provide the linkages among different pieces of information needed in subsequent reorganisation and combination processes (Ward et al. 1990). Even though, this conjecture could not be verified in all settings, and it seems that abstract principles may be of little value unless the individual links them to application in the respective problem situation (Mumford et al. 1996c), it is here hypothesised that there might be a facilitating effect in recognizing entrepreneurial opportunities.

H_8: Category search based on underlying or general principles facilitates the recognition of entrepreneurial opportunities.

Equally, conceptual knowledge organised on the basis of higher-order goals - that means broad, long-term goals - seem to contribute to creativity. They include a number of discrete events and, simultaneously, facilitate the construction of the linkages necessary for creative combination and reorganisation (Carlson and Gorman 1992; Crouch 1992). Furthermore, it seems as if they provide a flexible, rich and rather broad organising structure for organising and recalling an individual's prior life experiences in the current problem situation (Barsalou 1991). Based on the broad structure, goal-based concepts may allow an individual to organise and integrate a diverse set of activities, thus, again, facilitating creative performance (Csikszentmihalyi and Sawyer 1995). Unfortunately, there still exists rather vague knowledge on the exact mechanisms by which long-term goal-based concepts contribute to creative outcome of problem-solving efforts (Mumford et al. 1996c). Notwithstanding, it is here suggested that it might play a role in opportunity recognition.

H_9: Category search based on underlying long-term, higher-order goals facilitates the recognition of entrepreneurial opportunities.

Again regarding this hypothesis it is argued that an individual characterised by a promotion-style regulatory focus in problem construction and information encoding also has a preference for selecting existing knowledge categories based on the goals found in a situation. However, it must be thoroughly investigated if such a hypothesised focus really exists at all, if so, whether independently for each information process or a positive correlated between two or all of these processes can be found. It might be asked at this point why a potential preference for restrictions, a prevention-style regulatory focus, is not assessed for the process of category selection. As has already been said in the introduction to this chapter, only such types of preference are included as potential influences of opportunity recognition that are considered relevant in literature on creative thinking or opportunity recognition; to the authors knowledge this is not the case and, therefore, an assessment is abstained from in order to keep the complexity of the model manageable.

Some scholars argue that the activation of categorical knowledge focussing on the evaluation of one's own or other's performance might inhibit creative thinking (Amabile 1983). However, an experiment has shown that individuals seem to have a tendency to use such social evaluation concepts, comparing themselves to peer groups, and this only marginally impedes creative thinking (Mumford et al. 1996c); however, again it will be assumed that such a significant relationship exists.

H_{10}: Category search based on social evaluation (social peering) inhibits the recognition of entrepreneurial opportunities.

Another type of categories that might impede creative thinking are those reflecting fixed action plans or scripts because they impose some rigidity on an individual's solution strategies on the one hand, and have some difficulties in organising events in terms of discrete actions (Reiser et al. 1985).

H_{11}: Category search based on specific action plans might inhibits the recognition of entrepreneurial opportunities.

Besides treating them rather independently, information encoding and category search are likely to appear in tandem in complex problem-solving efforts (Mumford et al. 1991). Intuition suggests that initial information will activate certain categories, which then influence subsequent encoding, while serving to activate still other categories through new information and category relationships. In case there is no need to acquire new information, they, however, may be executed in a rather discrete manner.

This close interplay of the two processes gives reasons for identifying common individual and situational factors, aside from problem or information type. As to the individual aspect, expertise conditions the amount and nature of information encoded, along with other differentiated extra-cognitive variables, for instance energy levels[xxix], problem sensitivity, tolerance for ambiguity, interests, and mastery motives (Barron and Harrington 1981; Dweck 1986). Regarding contextual variables, they should have an impact on information encoding and category search through attentional resources and information access (Langley et al. 1987). Resulting, it is likely and often hypothesised that search processes will lead to a set of categorical structures to be included into the problem representations. Simultaneously, this implies that certain constraints have to be imposed on the number and nature of the categories applied, i.e. the best-fitting categories must be specified (Mumford et al. 1991).

The categorisation of incoming information, respectively the activation of a limited number of categories, is necessary because it reduces the complexity of the external stimulus by organising objects into meaningful groups (Dutton and Jackson 1987); the fact that such incoming information's categorisation is not symmetric or mechanistic is one of the main sources of new ideas and creativity (de Bono 1992). However, apparently, not all extant categorical knowledge structures available to an individual in a given situation are equally likely to be included in the problem space. Instead, there should exist some mechanisms guiding this decision. Lots of operations could be thought of playing a role in this process. Generally, it is assumed that the identification or recognition of the specific instance under consideration depends on the degree of overlap between the issue characteristics associated with the cognitive schema and the salient characteristics of the specific instance (Tversky 1977).

For instance, research suggests that individuals tend to retain those categories showing the best fit in terms of ideal, frequent, or typical exemplars with previously encoded information (Barsalou 1983). Furthermore, it seems that categories associated with significant constraints and inappropriate goals are likely to be eliminated (Mumford et al. 1991), while categories closely linked to each other through prior association and effective use are often retained, particularly in case of associated procedural and declarative categories in an integrated set (Krietler and Krietler 1987a,b). Again, some variables that exert influence on this systematic evaluative process have been identified. It seems that both, an individual's expertise and intelligence, are positively correlated with the process operation's efficiency. Additionally, cognitive complexity, flexibility, and openness shape the evaluation criteria's nature and, thereby, process operation's outcomes (Mumford et al. 1991). Further to this, the external environment imposes performance pressure and stressors on the individual at hand (Fiedler and Garcia 1987), for example leading to social pressure by influencing perceptions of category appropriateness (Mumford et al. 1991).

As laid out above, besides an individual's efforts to search for additional information externally, it internally selects a set of schemas that serve to organise available information and provide a basis for upcoming cognitive efforts. More formally, this process of searching appropriate knowledge categories is based on $TR^2_{t,j,k}$ and the additional information $AI_{t,j,k}$ resulting from the processes of problem construction as well as information search and encoding. The category search process in the economic agent's memory specifies a set of categories from extant knowledge $(EK_{t,j,k})$ that will allow pertinent procedural and declarative information to be organised and interpreted. In other words, the economic agent tries to make sense of the situation, and, thereby, to refine the problem representation by searching his memory for available schemas, which were built by prior situations.

In the context of entrepreneurial opportunities the question arises, which set of schemas economic agents should retain or activate in order to generate useful, new opportunities in a specific economic situation at a point in time? As outlined before, research in other domains indicates that the preference for a type of categories might have an impact on the outcome of the whole thinking process. In the present model, the concepts of schemas are varying as to the content pertinent to the economic situation at hand. The schemas activated are either based on similarity with the previously activated representation *($TR^2_{t,j,k}$)* regarding (1) underlying or general principles (*TI^P*), (2) underlying long-term, high-order goals (*TI^G*), (3) social evaluation of third persons (*TI^S*), or (4) specific action plans (scripts) (*TI^A*).

Once again, this preference for activating certain schema based on types of information is expressed by the factors p^{CS} to a^{CS}. Thus, the set of knowledge structures activated $EK_{t,j,k}$ from memory in category search and specification processes could be described as a set consisting of information of the types mentioned above as follows:

$$EK_{t,j,k} = p^{CS}_{t,j,k} \cdot TI^P + g^{CS}_{t,j,k} \cdot TI^G + s^{CS}_{t,j,k} \cdot TI^S + a^{CS}_{t,j,k} \cdot TI^A$$

with: $p^{CS}_{t,j,k} =$ Preference for general principles in category search.
$g^{CS}_{t,j,k} =$ Preference for long-term goals in category search.
$s^{CS}_{t,j,k} =$ Preference for social-peering in category search.
$a^{CS}_{t,j,k} =$ Preference for action plans in category search.

If an economic actor has activated a specific set of pertinent schemas, a subsequent process is responsible for selecting or specifying only a few out of this set of schemas for following thinking processes. An economic agent is assumed to specify these categorical knowledge structures that best explain the information encoded so far. This means the economic agent finally builds up the relevant problem space or means-ends framework $ME_{t,j,k}$ for this economic problem. Based on findings in other domains, there must be one mechanism assumed to be active in selecting the categories. For instance, it could be hypothesised that economic agents tend to retain the categories with the best fit in terms of ideal, frequent, or typical exemplars with previously encoded information.

Alternatively, they might select categories associated with significant constraints and eliminate inappropriate goals are. It could also be that categories closely linked to each other through prior association and effective use are retained. Anyway, it can be said that these remaining schemas are selected from set $EK_{t,j,k}$. Since the terms shown only represent a relative view on the composition of the representation, the $f_{t,j,k}$ are simply depicting the type of schemas activated and not a specific set, principally a similar term describes the composition, only with different preference factors:

$$R_{t,j,k} = p_{t,j,k}^{SC} \cdot TI^{P} + g_{t,j,k}^{SC} \cdot TI^{G} + s_{t,j,k}^{SC} \cdot TI^{S} + a_{t,j,k}^{SC} \cdot TI^{A}$$

with:
$p_{t,j,k}^{SC} =$ Preference for general principles in category search.
$g_{t,j,k}^{SC} =$ Preference for long-term goals in category search.
$s_{t,j,k}^{SC} =$ Preference for social-peering in category search.
$a_{t,j,k}^{SC} =$ Preference for action plans in category search.

Admittedly, when the best fitting categories have been selected, there is not much novelty in such thinking yet; it is rather created on the basis of this 'raw material' (Bejar et al. 1991). Now that the economic agent has come to a mental representation of the economic situation, it might be the case that he selects an option of action out of the already available set for this slot. However, it has been argued that opportunity recognition is here seen in altering this set of actions. How can be accounted for this in a general model like the present?

3. Category Combination and Reorganisation

Most researchers - and even laypersons would intuitively - agree that something cannot be created from nothing (Mumford et al. 1997b). Individuals rather work on existing knowledge that is combined and reorganised in order to come to a new idea or understanding (Mobley 1992; Finke et al. 1992; Mumford and Gustafson 1988; Rothenberg 1986; Simonton 1990; Weber 1992). Several empirical studies suggest the high importance of this process for creative thinking (Mumford and Gustafson 1988; Owens 1969; Rothenberg 1986). The main aim of this process it to bring about the generation of an interrelated sequence of actions likely to cause the achievement of the goals inherent in the problem-solving effort. In other words, it is the process of linking procedural and declarative categories within themselves and with each other in order to generate a novel action plan, altering an economic agent's set of available options of action.

Further to providing an information base for generating new problem solutions from earlier learning, combination and reorganisation of existing categories lead to other aspects of the creative act, which are also of some significance. For instance, processes range from creation of totally new information categories for use in problem-solving to a relatively simple rearrangement of the linkages among existing categories and category elements, leading to different degrees of output novelty (Barsalou 1983; Ward 2004). In addition, new arrangements may bring new features to the forefront (Finke et al. 1992). These new features, often referred to as emergent features (Ward 2004), might be accompanied by implications that represent significant extensions of the concepts used as input for the combination and reorganisation process. In fact, empirical results suggest that such emergent features, together with further exploration and elaboration, really seem to provide an important basis for creative thinking by providing ideas substantially different form the merged ones (Mumford et al. 1997b; Rothenberg 1979; Ward 2004).

These assumptions are based on substantial evidence for the importance of this process in creative thinking. Historical studies of artists and scientists suggest that creative outcome was often achieved by the linkage of previously unrelated concepts (Koestler 1964; Kuhn 1970; Rothenberg 1986; Weber 1992). Other studies of a similar type revealed that the combination and reorganisation of extant knowledge structures led to important advances in the fields of electromagnetic theory and powered flight (Crouch 1992; Tweney 1992). Based on the findings of experimental studies (Rothenberg 1973, 1986; Rothenberg and Sobel 1980; Maier and Burke 1970; Maier and Thurber 1970), more recent attempts aim at identifying the specific cognitive operations involved in the process, i.e. the processes of secondary (see e.g. Baughman and Mumford 1995; Finke et al. 1992). In a more specific study, Mumford et al. (1997b) assumed that an individual's ability to combine and reorganise categories could be best measured by the principal constituents of concepts (the category exemplars and features).

Information included in such newly built categories, as well as the new linkages between existing categories, depend on the characteristics of the individual at hand, the categories available to him, and the history or path of the problem-solving effort. Therefore, content and implications of this restructuring may be somewhat idiosyncratic and only loosely linked to consensual, culturally-defined knowledge structures (Mumford and Mobley 1989; Scott et al. 2005). Their nature implies some degree of domain specificity of the creative thought, just as dependence on these categories and basic operating processes allow for some generality (Mumford et al. 1991). Four processes of secondary order can be conceived to be in operation in category combination and reorganisation (see Figure 40): (1) the identification of central properties or key features of category members, (2) the mapping of the identified features or properties for one category onto the features of other categories, (3) the use of shared features to construct a new category, and (4) the identification of additional feature or properties of category members through elaboration (Bejar et al. 1991; Baughman and Mumford 1995; Mumford et al. 1997b). These processes result in a novel problem representation *NPR*.

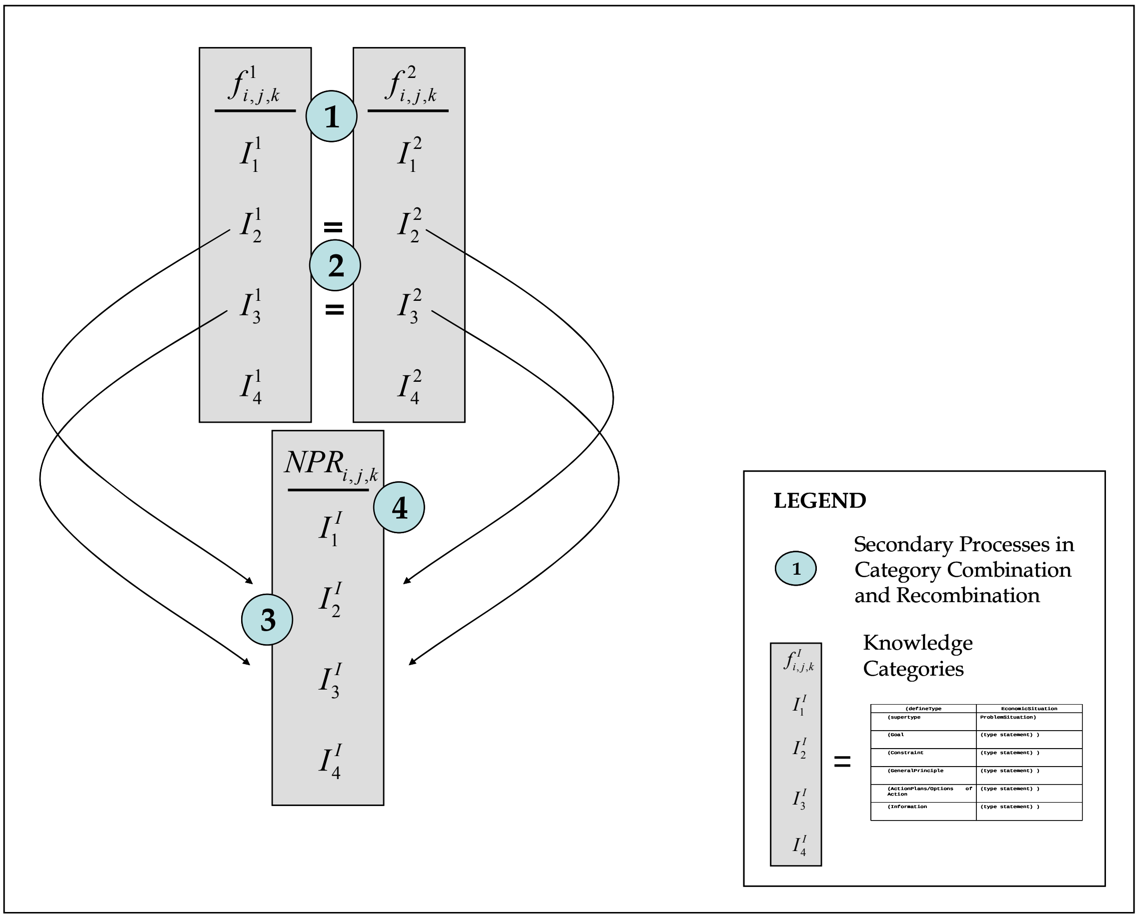

Figure 40 Outline of the Combination and Recombination Process.

Although some results suggest that in this case metaphors or broader analogical implications of these features substitute isolated and concrete features (Tourangeau and Rips 1991; Tourangeau and Sternberg 1982), the exact mechanisms for the case of diverse categories are still rather unknown (Mumford et al. 1991; Mumford et al. 1997b), intuitive variables must serve as basis for designing potential factors of influence. Intuition suggests that the overlaps in organising principles and category exemplars as well as commonalities in elemental or procedural steps are essential in guiding the process. The same seems to apply to the available analogical models an individual disposes of and its divergent thinking skills (Holyoak 1984; Medin and Ross 1989; Owens 1969; Runco and Albert 1985). Furthermore, it is likely that reasoning capacity and concerted active processing are positively correlated with creative category combination and reorganisation (Mumford et al. 1991).

In addition, further research indicates the efficiency of process operation across individuals might vary contingent on differential variables, such as self-esteem, organisation, independence, flexibility, openness (Feldhusen and Hobson 1981; Houtz et al. 1989; McCrae 1987). Similarly, so called climatic variables are assumed to influence an individual's category combination and reorganisation efforts. These are aspects such as communication, peer reports, norms stressing the value of alternative ways of looking at things, etc. (Abbey and Dickson 1983; Knapp 1963). In the end, independent of heuristics or knowledge structures an individual applies (Scott et al. 2005) the whole process should produce a potential problem solution (or a set of problem solutions), which has to be evaluated, whether is satisfies the relevant requirements. There is also reason to hypothesise that active directed search for relations between categories has an influence on an individual's performance (Mumford et al. 1997b).

However, related to the field of entrepreneurship, several transformational concepts are discussed that are all based on the recombination of extant knowledge structures since such conceptual combination might be of high relevance in the search for new means-ends frameworks in economic settings (Ward 2004), thereby breaking the existing framework (Gaglio and Katz 2001). More practically, mentally combining apparently unrelated or even opposed concepts, called Janusian thinking, might be useful for generating new products or services (Rothenberg 1979; Ward 2004). For example, reasoning about opposing consumer wants might contribute to find gaps in product spaces or reaching a target audience by marketing measures (Ward 2004).

Further, it might be argued that novelty in economic settings often results from combinations that represent specialisations, going down the hierarchical network; for instance, running shoes are a specialisation of athletic shoes in general (Ward 2004). For instance the process of bisociation is assumed to be the essential process in bringing knowledge together; this approach starts with the general subjectivist conjecture of schema theory that the perceptions and interpretations of the marketplace, respectively an industry or branch, possibly vary among individuals. It is argued that they differ due to differences in the schema content and complexity, which are built or activated in response to an identical stimulus (Gaglio 1997). This implies that the human mind executes an association process, which links the perceived elements. Based on this notion that the creative process is the formation of associative elements of different concepts into new combinations, i.e. new concepts, through bisociation (Mednick 1962), it is argued that bisociation is the thinking mode mainly applied in opportunity recognition (Ko 2004; Ko and Butler 2003, 2004). It is seen as the process of combining knowledge structures, which finally allows an economic agent to recognise an opportunity (Smith and Di Gregorio 2002).

Ko (2004) developed an entrepreneurial identification framework that is built up by several stages, which include divergent as well as convergent thinking. Although the approach is nothing more than an idea that intends to consider the concept of recombination in the context of opportunity identification (Ko 2004), it seems reasonable to emphasise its role in the present work due to several reasons: (1) it directs attention to the cognitive ability to process information, (2) considers the importance of different industries, already pointing to the nexus of individual and opportunity, and (3) assumes that such cognitive abilities can be learned separated from relevant knowledge.

A further process that could be subsumed in this chapter is the potential role of analogical reasoning in recognising or constructing entrepreneurial opportunities (Gaglio and Katz 2001). The term refers to the application or projection of an individual's familiar domain to a novel or less familiar one (Ward 2004). In the present work it is seen as one way (or manner) to reorganise extant knowledge structures, although it is sometimes mentioned as an independent process in other process models (see e.g. Finke et al. 1992; Ward 2004). In the context of analogies underlying principles might be of particular importance since these can help to transfer ideas from one domain to another. Being more precisely, it is often argued that creative advances are obtained in close conceptual domains (Ward 2004). Entrepreneurs might profit from analogies on two different levels. Firstly, several transfers from underlying principles in one area to others yielded a profit, in particular as variations for special target groups of customers. Secondly, such analogies seem to be relevant in selling a novel idea to customers; this refers to the dual nature of information that always includes some degree of familiarity.

Such familiarity is the dominant aspect in the concept of mental simulations that can be seen as rather imitative cognitive constructions representing an event or a whole series of such based on a causal sequence of successive interdependent actions (Gaglio 2004; Gaglio and Katz 2001). Put more informally, the term describes the ubiquitous thought everyone knows reasoning about what is going to happen in a given situation. Mental simulations seem to have two functions, of which one is of more affective nature, providing an individual the opportunity to re-experience and process emotions. Such aspects are not as important in the stance of the present work as it is the second function of preparation. By mentally simulating a situation or event, individuals can anticipate the environments and conceive strategies or tactics in order to achieve the pertinent goals: By doing so, individuals seem to estimate probabilities and causality using it as a heuristic for evaluating options of actions (Gaglio 2004).

The actual value of this heuristic seems to be derived from changing, altering, or mutating something in the mental simulation. Such changes can consist in (1) changing the amount or degree of some element of the representation, i.e. a slot of the frame, (2) deleting it altogether, (3) substituting something else entirely different, or (4) leaving original elements but adding some, etc. (Gaglio 2004). One specific type of mental simulations is called counterfactual thinking and is characterised by thinking in a way that is contrary to existing situations (Gaglio 2004; Gaglio and Katz 2001) or what might have been if things went different (Baron 2000). However, it could now be argued in which way mental simulation and counterfactual thinking of alert individuals differ from that of less-alert ones?

While earlier studies alleged that entrepreneurs engage in less counterfactual thinking (Baron 2000), refined works later on indicated, among other aspects, the they might engage earlier in such thinking, more intensive, more elaborated than subconsciously, thereby generating counterfactuals that maintain the novelty. Another preference of entrepreneurial economic agents in this regard might lie in that they work forward in conceiving the mental situation, i.e. begin by a starting point changing the outcomes of the situation instead of working backward, which means they presume a desired outcome and change potential causes leading to this (Gaglio 2004). However, more generally, all these processes describe a combination or reorganisation of knowledge categories, reason why they can all be subsumed here.

Modelling this formally, it can be said that the set of specified schemas included in *PR* provides the base on which economic agents combine and reorganise knowledge in order to come to a new idea or understanding of the economic situation. The main aim of these processing efforts is the generation of an interrelated sequence of actions likely to cause the achievement of the goals inherent in the economic problem-solving effort. Since the mechanisms guiding category recombination are still rather unknown is seems not feasible to investigate on individual preferences in this process. Therefore, the assessment must be restricted to a general level by attributing a general ability to do this cognitive process, varying between economic agents. Thus, statements about specific preferences or strategies are not made; more basic research in psychology must be awaited, helping to structure such an observation in the context of entrepreneurship. In other words, the process of category combination and reorganisation results in procedural and declarative categories that are linked within themselves and with each other in order to generate new problem solutions. The outcome of such processes ranges from creation of totally new means-end framework $NPR_{t,j,k}$ for use in solving economic problems to a relatively simple rearrangement of the linkages among existing categories and category elements. Subsequently, it assumed that an economic agent's ability of combining knowledge categories is compellingly positively correlated with high novel outcome of the economic problem-solving effort (Mumford et al. 1997b).

H_{12}: An individual's high ability to combine and reorganise categories facilitates the recognition of entrepreneurial opportunities.

Again, it should be emphasised that information included in such newly built categories, or also the new linkages between existing categories, depend on the characteristics of the individual at hand *j*, the categories available to him, and the history or path of the problem-solving effort *k* at that point in time *i*. However, this subject nature again implies that the outcome of the thinking process is not necessarily creative or a new solution to a problem. It is only assumed that the economic agent tries to find the best solution to an economic problem; this has to be evaluated afterwards:

The main function of the process of ideal evaluation in creative thinking is to evaluate the potential utility of the problem solution, respectively option of action, resulting from previous processing efforts considering the pertinent goals in the situation. The task had occupied a prominent role in the early literature on creative thinking, already included in early works on creativity (Dewey 1910; Osborn 1953; Wallas 1926), but was mostly ignored in subsequent research efforts (Mumford et al. 1991). However, there is evidence suggesting a significant role of this process in real-world creative thinking produced by research on the predictive value of frequency-controlled, high-quality divergent thinking scores (Cronbach 1968; Harrington et al. 1983; Runco and Albert 1985).

Generally speaking, it is the process of evaluating the ability of a proposed problem solution to satisfy the goals set in the process in an efficient manner within the constraints set in the initial problem construction phase. Apparently, projected contingencies and expected pay-offs from the solution implementation are taken into consideration by the individual (Hogarth 1980; Rubenson and Runco 1991; Torrance 1965). Such contingencies might be of climatic, motivational, and environmental nature. These can be role models, reinforcement contingencies, and concrete intellectual functions: In particular, variables conditioning decisions biases and decision making operations (Einhorn and Hogarth 1981; Hogarth 1980; Kahnemann and Tversky 1972).

In connection with that recent work arguing that intra- or interpersonal locus of evaluation is related to creativity could be mentioned (Runco 1992; Runco and Vega 1990). Further variables might be differential constructs, such as risk-taking, curiosity, and self-esteem influencing the willingness to pursue untried, new ideas (Mumford et al. 1991). Although the general importance of evaluative skills in creative thinking is undisputed, timing seems to play a crucial role since there is also evidence in the literature suggesting that evaluation tends to inhibit it (Amabile 1983; Finke 1995). For instance, in the process of category selection it might overly limit the individual's thinking.

While many general models of creative thinking suggest including idea evaluation as one of the main processes, scholars in the field of entrepreneurship suggest that the evaluation of opportunities should not be included in models of opportunity recognition since it principally belongs to the exploitation phase of the entrepreneurial process (e.g. Shane 2003; Ward 2004). The author is convinced that the superficial conflict can be resolved by taking a closer look at what the scholars in the different fields mean by their terms. Entrepreneurship scholars refer to a full evaluation of the opportunity and its subsequent detailed development to transform it into a real marketable product, service, etc. (Ardichvili et al. 2003; Baron 2004a) The crucial point is that from a cognitive perspective an individual has already decided on an opportunity's general configuration. This is not the case in the models of creative thinking; they assume that convergent thinking efforts produce rough potential problem solutions, which have to be evaluated in convergent thinking efforts in order to find the most appropriate one. The further elaboration of this selection chosen could be cognitively seen as detailed evaluation in the sense of entrepreneurship scholars. Consequently, there is no contradiction between the two fields since entrepreneurship researchers do not exclude general, initial assessments in the meaning of convergent thinking from opportunity recognition (Baron 2004a; Craig and Lindsay 2001). As Baron (2004) puts it: "It is important, however, to distinguish this initial relatively automatic check of feasibility from the much more extensive and effortful (i.e., analytic) assessments of feasibility or potential profitability that follow." (Baron 2004a, p. 52)

Most approaches to opportunity recognition account for this distinction; for instance Gaglio and Katz (2001) call the former a sensitivity to profit potential, which means that alert individuals have a superior ability to initially evaluate the profit potential of ideas and events.

However, they also emphasise the importance of distinguishing analytically between opportunity identification and evaluation. In summary, the present work regards idea evaluation and such studies (e.g. Crawford 1980; Keh et al. 2002; Long and McMullan 1984) as belonging rather to opportunity exploitation. It resembles to an economic agent's decision for one available option of action since the convergent thinking efforts that are here regarded as evaluation are part of any divergent thinking effort, as has been outlined before; i.e. it is rather a question of a somehow rational decision making process. Consequently, this process is not considered being a central part of the process of cognitive creation and, therefore, not investigated empirically

[xxv] "In sum, a cognitive perspective suggests that individuals can improve their ability to recognise opportunities through the use of strategies suggested by theories of perception and cognition. Given that many entrepreneurs waste their own – and others' – time, energy, and resources on 'false alarms', training individuals to be more effective at opportunity recognition would appear to be highly worthwhile." (Baron, 2004a, p. 69)

[xxvi] Pech and Cameron (2006) have published a study along these lines, which is not presented in detail since this model is a very general mapping of a broad information processing architecture and seems to be methodologically rather weak since only based on one interview with a successful entrepreneur. The particular setting of the business and, therefore, the nexus between individual and opportunity is not considered. However, the psychological assumption underlying this work that fundamental attributes of individuals, rather than information about opportunities, determines the recognition of entrepreneurial opportunities is supported in the present work; thereby justifying the concentration on cognitive processes (Pech and Cameron, 2006).

[xxvii] "The Popperian approach sees entrepreneurship as a kind of scientific process of discovery and learning in which entrepreneurs form conjectures, select which ones to test and make judgements about revising them in the light of evidence form testing their plans in the market." Harper (1999), S. 2; vgl. zu den Grundzügen Popper's Theorie des Wachstums von Wissen Harper (1999), S. 8 ff. oder grundlegend Popper (1959).

[xxviii] Please note that the structures build by representational elements are also knowledge concepts in the sense of $f_{t,j,k}$. However, they are named differently in order to point out the difference to other concepts in subsequent processes.

[xxix] This notion originates from the Energy Paradigm in Psychology, based on the main assumption of Einstein's dictum that energy and matter are interconvertible aspects of the same reality (Gallo, 2005 p.10). The term itself refers to the Motivation for Action (Eysenck and Keane, 2000)..

"Moreover, all of these possibilities can be readily investigated in future studies employing well-established methods research developed in the field of cognitive science." (Baron 2004, p. 67)

V. Assessing Cognitive Styles and Opportunity Recognition

The general research process can be divided in several steps, stages, or phases; a clear structuring should not only help the scholar in pursuing the goal of highly qualitative research, but also help the audience to comprehend the researcher's thoughts, ideas, and intentions. Stage-models depicting the research process in social sciences are, apart from terminological issues, quite similar (e.g. Alemann 1977; Baker 1988; Hartman and Hedblom 1979): In a way, all the previous parts of the present work could be seen as efforts of (1) defining and delineating the research problem related to relevant theory in different scientific fields; i.e., a theory or model has been developed, which ought to be tested empirically. Sometimes, this phase is referred to as classification, which means that the scholar stays descriptive in dealing with the topic (Hartman and Hedblom 1979).

Based on the purpose of study (see chapter I.B), the (2) hypotheses are formulated and (3) data collected that is appropriate to test or analyse the hypotheses. Afterwards, the (4) results are interpreted, generalised, or inferred; if necessary - e.g. if data does not support the prediction made or extends beyond present limitations - the (5) underlying theory is recasted or modified. The following chapter adheres to such a proceeding: The first part A deals with the general survey design, the formulation of measurable hypotheses as well as a discussion of the sample drawn, and the items or measures developed to assess cognitive styles and opportunity recognition. Part B of this chapter provides the reader with a brief introduction to the basics of causal analysis and structural equation models; these allow thoroughly analysing the constructs used and relationships hypothesised in the final part C of this chapter.

However, recalling the central purpose of study intended to be obtained in the present work, it is intended to give some answers to the central question why some people and not others are able to discover particular entrepreneurial opportunities, approaching the question from a cognitive perspective? In other words it could be asked, if individuals that discover particular entrepreneurial opportunities apply different thinking processes than those who do not?

A. Preparing the Study

1. Survey Design

In chapter III.C it has been said that cognitive research on the creation of novelty in any setting is often based on the retrospection of individuals, also in research on entrepreneurship, for instance in by doing surveys or in-depth interviews that request the recall of pre-launch or start-up activity (for instance Busenitz 1996; Kaish and Gilad 1991; Pech and Cameron 2006). Such a proceeding of asking subjects how they recall the processes involved is critical and bears many problems. The main problem lies in the fact that creation of novelty is assessed ex-post. Consequently it is argued that such data collection methods cannot capture the phenomena of opportunity identification.

In fact, other data collection methods must be developed allowing the subjects to submit their thoughts at this moment of time instead of solely reporting on what their perceptions and thinking processes were in the past (Gaglio and Katz 2001); how biased such memories should have become apparent during the presentation of the Challenger study (Neisser and Harsch 1992) in chapter II.A.1. Such more appropriate methods could be seen in concurrent verbalisations (Ericsson and Simon 1984) or the confrontation of individuals with scenarios that include appropriate stimuli as often done in behavioural decision making research (e.g. Elliott and Archibald 1989; Highhouse and Yuce 1996; Mumford et al. 1996).

Such studies must be capable of reliably and validly capturing cognitive processes. This requires that investigators executing such studies must find the difficult balance between constructing scenarios ruling out alternative explanations of decisions, but are simultaneously not so rigidly structured that they preordain the decisions through a demand characteristic inherent to the scenario. Furthermore, the environment of such scenarios must be controlled so that no distractions activate other schemas; however, not few scholars argue that in general experimental, quasi-experimental, or laboratory approaches seem promising for investigating cognitive aspects of opportunity identification that can be modelled as vignettes and simulations like framing effects, changing schema, or recombinational process such as counterfactual thinking (Demmert and Klein 2003; Gaglio 2004; Gaglio and Katz 2001; Gaglio 1997; Shane 2000).

In the present work it was intended to find first insights on causal relations between information-processing and opportunity recognition. The general idea of how to assess an individual's preferences is based on the measurement of attitudes in controlled settings. In a very general manner "[A]n attitude may be defined as a presumably learned predisposition to react in some characteristic manner with respect to a particular stimulus. The stimulus might be virtually anything […]." (Cohen et al. 1988, p. 564) Attitudes are assumed to be quite solid and stable over time compared to the concepts of beliefs and opinions, which seem to vary more over time. Therefore, it could be argued that attitudes can be seen as schemas or rather stabile individual preferences, i.e. general cognitive structures like cognitive styles that serve an individual to construct its world based on previous experiences (Eagly and Chaiken 1993). Hence, general methodological instruments for measuring attitudes might be transferred to the field of general information processing preferences (see for a general treatment of attitudes in the IPP Eagly and Chaiken 1993, pp. 257-303).

Thus, it appears not very surprising that the method chosen in the present work strongly resembles to studies that are considered as classics for studying attitudes. For instance, in the study of Thurstone and Chave (1929) a small panel or group of people developed a list of statements concerning their options about the church. This pool of statements was then presented in a second step to another panel of 300 judges, asking them whether they felt a statement to be favourable or unfavourable towards the church on a scale of 11 possible ratings. By this proceeding an inter-subjective scale value of each statement could be derived by taking the average of rating; further, such a method allows calculating a level of ambiguity or, i.e., an indicator of agreement on the statement's nature. In a third and final step, such statements were selected that clearly reflected a particular attitude towards the church; by asking another sample of individuals it was possible to assess their attitudes towards the church by asking them to check each statement that expressed their own sentiments (see also Thurstone 1928).

As will be shown in the following, the proceeding of the present work is quite similar to that of this classical study of constructing an attitude scale (Henerson et al. 1988). This particular type of attitude scale construction is referred to as 'stimulus, then person scaling' or 'Thurstone-technique'. In this two-step process, stimuli, i.e. statements describing beliefs, affects, or behaviours, are judged and scaled to determine the location of each stimulus on a dimension. If each statement included in an item has a scale value, it is possible to locate subjects of the study on the same dimension by their answer behaviour, e.g. their endorsement of one or more of the scaled statements (Eagly and Chaiken 1993). The construction of scales for preferences in the present work is done quite similarly, replacing the dimension of favourability by preferences for a kind of information, as will be laid out in some more detail for each information process. However, all the scale values for each individual are construed on an interval scale, which allows ascertaining the exact size of the differences between the objects, representing individual preferences in the present work. In fact, variables scaled on an interval (parametric) are necessary to compute any averages, standard devices, variances, covariances or correlations, and, finally, to execute representational measurements on an interval level, i.e. to deduce relationships that exist empirically between the objects on the dimension scaled (Eagly and Chaiken 1993).

Based on this, the concept of the general cross-sectional survey design, collecting data at a single point in time (Fink 2006) has been adopted from a previous psychometric study, in which process-based measures of creative thinking were investigated in general settings (Mumford et al. 1996a, b, c, 1997). Thus, in a way the present study could be seen as a vague reproduction in the specific context of creative thinking in economic situations. Subjects participating in the survey were asked to work through as set of computer-administered measures that were organised in six blocks, whose development is summarised in Figure 41. However, in the actual survey working through this battery of tasks took them only about 45-60 minutes. While the first block was dedicated to assess some reference measures and to control for a homogenous sample, the second, third, fourth, and fifth block were supposed to investigate the information processes of problem construction, information encoding, category selection, as well as category combination and reorganisation. The sixth and last block included two tasks, which ought to measure the ability to recognise entrepreneurial opportunities.

The survey was done and data was therefore collected computer-based; this was necessary since, as will be explained later, measures for the process of information encoding could not be collected in a paper-based survey. In order to ensure the quality of this survey, its whole design was done according to the International Guidelines on Computer-Based and Internet Delivered Testing (Association of Test Publishers 2000). Throughout the whole survey it was not explicitly controlled for, but ensured that, affective states and task enjoyment stayed constant across all tasks and the whole population since there exists a great deal of evidence that positive mood and emotions states facilitate creativity and, thus, the quality and originality of answers given by participants (Friedman and Förster 2001).

Research Stage / Cognitive Process	Scenario Development	Panel I	Panel II	Survey	Panel III	Data Analysis
Problem Construction	4 Entre. / 4 General	Pool of 45-50 Answer Options for Each Question (By 3 Persons for Each Process)	Evaluation of Answer Options Concerning Type of Information (By 10 Persons for Each Process)	115 Business Students Majoring in Entrepreneur ship		Factor and Causal Analysis with Structural Equation Model
Information Encoding	4 Entre. / 4 General					
Category Selection	4 Entre. / 4 General					
Category Combination	4 Entre. / 4 General				Evaluation by 3 Experts	
Opportunity Recognition	2				Evaluation by 7 Experts	

Figure 41 General Research Concept.

Practically, the survey as a program was developed on basis of Wextor©, a software provided online to conceive web-based experiments (see for details Reips and Neuhaus 2002). This procedure significantly reduces the programming effort of a computer-based survey, which, in turn, allows to process data electronically right from the beginning of the research procedure. However, it should be noted that the survey was not web-based in its original sense, that is subjects were not allowed to participate from any place they could enter the internet, but were all invited to the same computer-equipped class room in the university. Another major advantage of such a computer-based proceeding was that subjects' answers and further measures were instantly written into and recorded in the log file of the hosting server. Thus, the data matrix showing relevant data for each subject, was finally obtained by analyzing the log file of the web server with another software called Scientific LogAnalyzer©, particularly designed for such a purpose (see for details Reips and Stieger 2004). Although study and results are presented in English, the entire questionnaire was presented in German, the subjects' mother tongue, in order to avoid any linguistic bias. Even though some of the participants grew up with another first language, they all do their studies in German; reason why a sufficient proficiency in this language can be assumed to rule out biases in comprehension.

Intuitively, some might argue that the assessment of opportunity recognition in an artificial laboratory setting does not provide results that allow inferring to the real-life phenomenon. Indeed, the ultimate goal of scientific studies of thinking is undoubtedly to provide an understanding of the nature and structure of all types of thinking; that is, if possible, the description in terms of general laws. Unfortunately, thinking occurs in everyday life activities, and, therefore, it is tempting to attain insights by observing thinking in everyday life as it occurs spontaneously. Apparently such observations in natural contexts are relatively demanding to manage for a lot of thinking processes (Ericsson and Hastie 1994). This also applies to phenomena that happen spontaneously or over a longer period; in any case it seems to hold true for opportunity recognition.

Currently, as kind of preliminary solution, most researchers share the conviction that observation and analysis in the natural context has to be combined with some type of systematic study, usually experiments, in order to study thinking (Ericsson and Hastie 1994). In general terms, two experimental routes or strategies in the study of general laws of thought can be distinguished: (1) Beginning in the laboratory with experimental designs that, although artificially, try to reveal the most general and fundamental thought processes. The assumption is that once the basics are established, everyday phenomena can be explained by a method of reduction. (2) Alternatively, informative, naturally occurring phenomena are examined in their natural context and then experiments in the laboratory are executed in order to reproduce the phenomena under controlled conditions. This permits analysis and eventually supports extrapolation back to the natural context (Ericsson and Hastie 1994).

The former approach turned out to be more popular among scholars in recent years; many have focused on uncovering general laws of thinking and cognitive processes by identifying the most simple and best controlled situations, in which reproducible phenomena obey general laws. These, if they are truly general, should operate in simple as well as complex tasks, which is the reason why the former ones are preferred for investigation. The idea to identify general laws under controlled conditions moving subsequently to analysing more complex tasks goes along with one of the main conjectures of information processing theory: The same basic processes determine simple as well as complex phenomena (Ericsson and Hastie 1994). Notwithstanding the significant advantage such an approach offers by permitting the researcher to isolate effects so that statements about causal effects are possible (see the brief remarks concerning causality in chapter V.B.2; it remains highly questionable to which extent these insights can be transferred to the actual phenomena in the real world (Neisser 1976; Haber 1983).

First of all it must be conceded that the examination of a phenomenon in the laboratory is always different from the examination in real life and indeed empirical evidence for the (positive) correlation between laboratory and everyday life performance has not been found so far; therefore, Ericsson and Hastie (1994) have to be supported when saying: “We are in agreement with the critics that one must be cautious in generalising from theories based only on laboratory tasks to everyday situation where much greater amounts of experience and knowledge are available to the thinker.” (Ericsson and Hastie 1994, p. 52) These two scholars already name the most striking difficulty in doing research on thinking processes: the role of knowledge. Hence, it seems that a researcher planning a study on information processes faces the task to dissect these from a subject's knowledge, which is, as already underlined, literally impossible. And even if possible to a large extent in some domains, how could such artificial tasks and the resulting insights attained in the laboratory be generalised to everyday life? Apparently, implications of results can only be drawn by taking account of the restrictions imposed by methodology.

A middle course between these two general research approaches might consist in identifying phenomena in everyday life and, then, trying to reproduce them under controlled condition in the laboratory to study them systematically. This tactic is quite popular in natural sciences but also some cognitive phenomena have been transferred successfully into controlled laboratory settings (Ericsson and Hastie 1994). Such a processing could be named a phenomena-based approach. It ideally requires that highly reproducible results can be identified, usually in form of large differences between two conditions or two groups of subjects. Additionally, it is necessary that the differences are stable and thus reproducible. In several domains performance can be directly measured and studied in the laboratory, for instance by reading or text comprehension, etc. (Ericsson and Hastie 1994). But also in other domains in which performance is more interactive and extends over long periods of time, controlled research under this complex conditions is possible, e.g. in chess (Charness 1991; de Groot 1965; Simon and Newell 1972). The named requirement of significant and robust differences in performance for such research is one of the main reasons why the comparison between experts and novices in a given domain is so popular in experimental studies.

However, the important conjecture of the information processing paradigm that acquired knowledge and skill is a major variable of individual differences in performance, in particular characterising experts, in a given task has already been mentioned. Since both methodological approaches presented above are based on this paradigm, the statement is generally accepted. Nevertheless, this assumption has different methodological impacts: The traditional laboratory-based approach intends to minimise the influence of previously acquired knowledge and skills to study the basic process more effectively. The phenomena-based approach, in particular the study of expert performance, emphasises the results of maximal influence of experience, respectively knowledge and skills.

It is this importance of knowledge and skill for performance in most tasks, which is the fundamental obstacle to infer everyday life performance from basic processes identified in the laboratory: The amount of domain-specific knowledge is, besides cognitive processing, the most predictable difference between novice and expert performance (Ericsson and Hastie 1994). It should be apparent that in a domain like the one dealt with in this work the duration of acquiring relevant knowledge and skills corresponds to month and years. Therefore, it is practically impossible to monitor all relevant activity. Besides these general disadvantages of such a phenomena-based approach it cannot be applied in this work because 'experts' in the field of entrepreneurial cognition are difficult to identify, as has been discussed in chapter II.B.3; it is not clear if cognitive characteristics have made an individual to become an entrepreneur and, thus, difficult to identify individuals that ought to be included in a study investigating entrepreneurial cognition.

A methodological solution to this problem consists in the use of well-defined tasks that dramatically restrict the relevant knowledge. The argument behind this is that even in a domain with large amount of knowledge, only a small fraction of that knowledge will be relevant to solve the particular problem at hand. More generally, it can be concluded that one important dimension as to the generalisability of results is definitely the complexity of task-relevant knowledge, which is relatively low in laboratory research on basic processes since this research intentionally minimises the influence of relevant experience and complex knowledge. Extremely high complexity of knowledge and experience is involved in expert performance in a specific domain that is within a constrained set of objects and activities. Between these two extremes, the diverse category of everyday thinking can be placed, corresponding to an intermediate complexity level of experience and knowledge. In Figure 42 the tree types of phenomena are visualised along the hypothetical dimension introduced above.

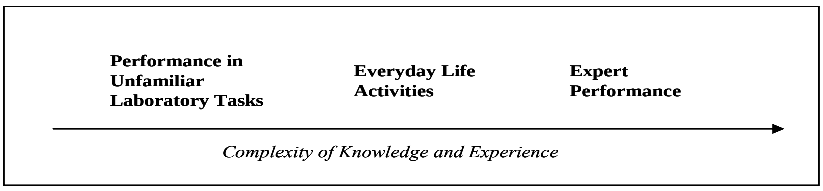

Figure 42 Hypothetical Task Dimension of Relevant Knowledge Complexity.

In order to control the availability and accessibility of task-relevant knowledge and strategies in laboratory settings, tasks ought to be well-defined and have explicit goals and measurable performance. Such settings provide strong cues for the participating subjects and constrain the retrieval of relevant information for a successful solution. Similarly, no pre-experimental experience is included in such settings, not allowing subjects to retrieve solutions or answers from memory (Ericsson and Hastie 1994).

2. Hypotheses Formulation and Sample

“For the purpose of this work, a hypothesis is defined as a tentative statement of the relationship between two concepts expressed as a probable statement of supposed fact. It is capable of being tested and verified by the data gathered to test it.” (Hartman and Hedblom 1979, p. 64-65) This general definition points out that a hypothesis is a special way of expressing a statement, making it testable based on available data. Hereafter, it will be very briefly outlined how hypotheses are generally conceived, starting with available theory and, then, presented which hypotheses are supposed to be tested in the present work, concerning the recognition of entrepreneurial opportunities.

Generally speaking, the process of developing appropriate hypotheses starts with relating concepts that have been developed before into propositions at a highly abstract level. A proposition consists of at least two concepts and a statement that describes the relationship between them; a proposition, therefore, describes a state-of-affair, which has to be clearly defined in order to reduce its ambiguity (Schlick 1990). As has already been said about concepts in the general context of knowledge in chapter III.B.2, they are an abstraction or symbol that represents similarities or common characteristics in a phenomenon. A theory could therefore be seen as a way of organising concepts and propositions in systematic ways; similarly, a concept could also be called a construct (Fortune and Reid 1999). A statement can be relatively abstract and may be likewise referred to as abstract, conceptual, or theoretical hypothesis. Subsequently, the level of abstraction is reduced, which means that in the end concepts and variables are identified as well as operationalised, resulting in the application of appropriate measures, judged to be relevant in answering the research question (Hartman and Hedblom 1979).

The process of operationalisation starts at a highly abstract level with so called general hypotheses (GH), which equal to general statements that are supposed to apply to the largest number of widest possible explanation schemes, statements are brought to the test. This may require a number of subhypotheses (SH) that describe the logically derived assumptions as to the relation between the aspect to be explained and the operational measures of the explaining construct. From this, the process of operationalisation develops operational hypotheses (OH), i.e. brings general hypotheses to a lower level of abstraction, so that operational hypotheses are linkable to the measurable world (Walliman 2004). Put differently, it can be distinguished between concepts or constructs and indicators or operational characteristics with which the former can be measured. Such indicators measure a particular construct, taking the role of so called operational measures or indicators only if so designated by the researcher. If conceptual subhypotheses have been developed, these are similarly transformed into operational subhypotheses. The third and last step in hypotheses reduction leads to the null hypotheses H_0, which always states that there is no relationship or association between operational variables.

This principle is based on the premise of falsification, that is it is impossible to prove a case by examining each and every of such cases possible in the universe; hence, researchers are not searching for approving evidence, but rather aim at finding exceptions to a statement that invalidate it (Popper 1935). The detection of a single exception leads to the rejection of the null hypothesis as not being valid (Hartman and Hedblom 1979). In a way, such a network of hypotheses resembles the way knowledge is often represented: Hierarchical networks, moving from higher-level, abstract concepts to measurable concepts down the network (see chapter III.B.2). However, criteria for judging testable or operational hypotheses have been conceived, which, principally, have not changed during the last decades and have been kept in mind in developing those used in the present work: Hypotheses should (1) be conceptually clear, i.e. the operationalisation of concepts ought to be based on generally accepted definitions in the literature, (2) have empirical referents, which allows for intra-subjective testability excluding value judgements, (3) be specific and clear by relating or contrasting single concepts, instead of including to many elements into a single hypothesis, (4) be related to available measurement techniques, and (5) be related to a body of theory (Goode and Hatt 1952).

In Figure 43 the general hypotheses tested regarding opportunity recognition in the present work are summarised; the corresponding operational hypotheses, depicted as well, are then further developed in discussing the measurement of constructs and statements.

Problem Construction and Information Encoding

GH_1: A promotion style of regulatory focus facilitates the recognition of entrepreneurial opportunities.

OH_1: 'The preference for applying representational elements about initial goals in problem construction and the preference for searching for information regarding goals that need to be addressed in solving the problem are positively correlated with the quality and originality in finding entrepreneurial opportunities.

GH_2: A prevention style of regulatory focus might inhibit the recognition of entrepreneurial opportunities.

OH_2: 'The preference for applying representational elements about significant constraints in problem construction and the preference for searching for information regarding restrictions or constraints that have to be posed on the problem solution are negatively correlated with the quality and originality in finding entrepreneurial opportunities.

Problem Construction

GH_3: An action style in constructing problems facilitates the recognition of entrepreneurial opportunities.

OH_3: 'The preference for applying representational elements about actions in problem construction is positively correlated with the quality and originality in finding entrepreneurial opportunities.

GH_4: An information style in constructing problems facilitates the recognition of entrepreneurial opportunities.

OH_4: 'The preference for applying representational elements about salient information in problem construction is positively correlated with the quality and originality in finding entrepreneurial opportunities.

Information Encoding

GH_5: An inconsistent information search style facilitates the recognition of entrepreneurial opportunities.

OH_5: The preference for additional factual information that was inconsistent with the initial factual data is positively correlated with the quality and originality in finding entrepreneurial opportunities.

GH_6: An irrelevant information search style facilitates the recognition of entrepreneurial opportunities

OH_6: The preference for searching for information irrelevant is positively correlated with the quality and originality in finding entrepreneurial opportunities.

GH_7: A principle search style facilitates the recognition of entrepreneurial opportunities.

OH_7: The preference for searching for information regarding underlying principles is positively correlated with the quality and originality in finding entrepreneurial opportunities.

Category Selection

GH_8: A principle style in category search facilitates the recognition of entrepreneurial opportunities.

OH_8: Category search based on underlying or general principles are positively correlated with the quality and originality in finding entrepreneurial opportunities.

GH_9: A goal style in category search facilitates the recognition of entrepreneurial opportunities.

OH_9: Category search based on underlying long-term, higher-order goals are positively correlated with the quality and originality in finding entrepreneurial opportunities.

GH_{10}: A peering style in category search might impede the recognition of entrepreneurial opportunities.

OH_{10}: Category search based on social evaluation (social peering) are negatively correlated with the quality and originality in finding entrepreneurial opportunities.

GH_{11}: An action style in category search might impede the recognition of entrepreneurial opportunities.

OH_{11}: Category search based on specific action plans are negatively correlated with the quality and originality in finding entrepreneurial opportunities.

Category Combination and Reorganisation

GH_{12}: An individual's ability to combine and reorganise categories is related to its ability to recognise entrepreneurial opportunities.

OH_{12}: The quality and originality of an individual's combination and reorganisation of categories are negatively correlated with the quality and originality in finding entrepreneurial opportunities.

Figure 43 Summary of Hypotheses Regarding Opportunity Recognition.[xxx]

The proceeding that concepts and hypotheses are developed, apparently calls for an analytical research design that allows addressing questions of association or causality. Therefore, data must be collected to test these hypotheses empirically; in order to keep complexity of a study manageable, data collection should be limited to providing data to test relevant problems of the study (Hartman and Hedblom 1979). In reality, the operationalisation of concepts and theories into measurable terms, which has been outlined above, bears many problems scholars have to solve; this particularly applies to a discipline like entrepreneurship research and those efforts to investigate entrepreneurial opportunities and their recognition. Such disconnections between theory and measurement constitute a serious menace to advancing knowledge about the opportunity identification process.

The following statement of a scholar doing research on opportunity identification summarises this arguments very well: “While we have collected numerous compelling anecdotes and case histories suggesting or illustrating unique qualities, these stories do not always hold up to scrutiny when subjected to systematic study. However, it is argued that the primary reason for this perceived failure is that our methodological choices do not always capture the kinds of people, firms, events or situation found in our stories. Developing sound and rigorous operational measures of entrepreneurial opportunities can be a direct path to locating the archetypical phenomena in order to examine whether uniqueness exists and if so, in what ways.” (Gaglio 2004, p. 130)

As has been pointed out explicitly and implicitly in chapter IV.A.1, scholars in entrepreneurial cognition research claim that entrepreneurs are different, but at the same time have significant problems to find evidence to that conjecture. If this axiom is taken as given, it might be possible that the failure to find empirical evidence of a distinctive mind or psychology is a result of flawed research methods (Carsrud and Johnson 1989; Shaver and Scott 1991). Put simple, it might be that the operational measures and samples used are not helpful to get valid results and, therefore, theoretical conceptualisations about entrepreneurs are simply not really tested (Gaglio 2004). Together with the argument already mentioned that entrepreneurship must achieve to demarcate its actual object of investigation, it is most pressuring that research on opportunity identification overcomes such shortcomings, if the discipline wants to corroborate its claim of distinctiveness. To achieve this, rigorous theoretical concepts and valid as well as reliable operational measures are needed that capture the essential meaning of these concepts.

Although some scholars object that the discipline is too premature to exhibit such rigor (see literature given in Gaglio 2004), the author is deeply convinced of the necessity for attempting such empirical research, if entrepreneurship research shall not be perceived as a mere research setting or even teaching application (Shane and Venkatamaran 2000). An extensive literature review by Gaglio (2004) has revealed that, regardless of the theoretical conceptualisations of an entrepreneurial opportunity underlying research, almost all entrepreneurship scholars use venture founders as the sampling frame. This means they are measuring entrepreneurial opportunities and their identification as venture creation. But the question is if this really is the necessary and sufficient dimension?

Considering the distinction explicitly made in this work between opportunity identification and exploitation such studies do not operationally capture opportunity identification. Bearing in mind that most studies are based on such a notion of entrepreneurial opportunities as venture creation, this has important consequences: The main advantage is that it is easy to measure, reliable, and intuitively appealing; in turn, the main disadvantage is the apparent inconsistency with the existing theories about entrepreneurship. Furthermore, this implies that most studies treat starting a hair salon or freelancing with radical innovations like Napster as equal. Evoking the assumption made that entrepreneurial opportunities are a heterogeneous group, such a methodology may significantly weaken research efforts. This might be another reason why many studies are not capable of finding significant differences, in this case often leading to type II error of accepting the null hypotheses of no differences (Gaglio 2004). Another, and probably the most concerning, aspect about using venture creation as operational measure for entrepreneurship is that the decision to start a venture can be quite convincingly explained by maximum utility theory, which gives rise to discussions as to the right to exist of entrepreneurship research (Gaglio 2004). This approach of classical economic theory regards venture creation simply as one option of action to be evaluated (Douglas and Shepherd 2000; Levesque et al. 2002). Yet another inconsistency between theoretical conceptions and research consists in that research discusses an opportunity in terms of new products, services or processes, or even new ways of organising the marketplace. But the operational measure used as opportunity actually includes two different kinds of opportunity: The opportunity to start a business and the market opportunity (equal to the theoretical one), which might or might not be novel. The ignorance of this distinction entails further shortfalls of what such studies can tell about opportunities and their identification.

In summary, all these arguments underline the necessity to clearly distinguish between creating a venture and finding an opportunity in form of a product, service, etc. (Gaglio 2004). Hence, it is a major task for the discipline of entrepreneurship to develop operational measures as well as appropriate research designs and samples to investigate entrepreneurial opportunities. In fact, all scholars doing research on opportunity identification face the problem of developing an effective sampling frame (Gaglio and Katz 2001), as has been outlined more explicitly in chapter II.B.3. In particular a view like the one offered in the present work is accompanied by such problems since, principally, opportunity identification as everyday life-phenomena can principally occur everywhere at any time The typical approach to sample those individuals who are assumed to have already demonstrated entrepreneurial characteristics is a post-hoc identification of relevant subjects; in psychological contexts very often experts and novices, i.e. entrepreneurs and non-entrepreneurs are compared.

However, this rather narrow approach to regard venture creation as entrepreneurship holds problems already mentioned: First and foremost it leads to a mix-up between different types of entrepreneurs belonging to different populations. This might lead to a false inclusion of individuals that have actually never identified an opportunity but only created a new venture. Further to this, this sampling method is often combined with retrospective data collection techniques, inducing the same insufficiencies already named before (Gaglio and Katz 2001). Alternatively, scholars could follow a prospective sampling strategy. The problematic aspect of this method is that individuals must be identified that have a position, which should place them in close proximity to entrepreneurial alertness and opportunity identification (Gaglio and Katz 2001). Such a sampling method has already been used in empirical studies on the phenomena (see Busenitz 1996; Kaish and Gilad 1991). Another alternative consists in using a population approach. This can be done if the scholars assume that the capability of recognising entrepreneurial opportunities is not a rare phenomenon, i.e. normally distributed in the entire population; then, samples can be taken from the general population (Gaglio and Katz 2001).

Indeed, the present work assumes that the ability to recognise entrepreneurial opportunities is normally distributed in the population, like many other talents, such as creativity or intelligence, as well. However, business students might be interesting as sample population since they represent a sufficiently large enough group of people actively engaged in opportunity identification (Gaglio 2004). Students taking major courses in entrepreneurship in the latter years of their studies could be seen as having a propensity to opportunity recognition. Of course it has to be admitted that they will initially not develop radical or revolutionary innovations or entrepreneurial opportunities. However, the most important, advantage of using business students as a sample is that such a study cannot confound opportunity identification and exploitation since students are yet considering starting a business, as yet not really doing it (Gaglio 2004).

In conclusion "[…] future research could even use samples of MBA entrepreneurship students to produce reliable results about the cognitive processes of this theoretically narrow topic." (Gaglio and Katz 2001, p. 108) The sample or the subset of the population under study (Grinnell and Williams 1990) in the present work indeed consisted of postgraduate students at a German university, doing studies in business administration, majoring in entrepreneurship. The sample included 115 individuals of which 54 were male and 57 female, while 4 did not report their gender. The average age in the group was at the time of the survey approximately 24 years. Of these students 16% (19 individuals) had already started a business on their own and 46% (54 individuals) had at least one family member (parents or brothers and sisters), who had already started a business.

3. Measures and Items

Generally, any survey item was designed according to six basic principles that are assumed to keep it as simple as possible for participants while guaranteeing a sufficiently elaborate level to ensure methodologically acceptable results (Converse and Presser 1986). The first aspect to consider is (1) the use of a common tongue with frequently used terms and words, e.g. by finding synonyms for technical terms and Latin constructions; the scholar must remember that comprehension is more important than lingual conventions. Similarly, (2) common concepts should be included that can be understood by non-experts and less-educated people, e.g. avoiding that participants must calculate proportions or percentages. (3) Such ought to be put into short questions that are only as long as necessary for triggering an expected response: e.g. a more detailed question if a more detailed answer is desired for a highly important item.

Fourthly, (4) confusions should be avoided that might be caused by several types of aspects. Such could be the inclusion of a double vision, which means that spuriously two stimuli - here two attitudinal objects - are given in one item; this refers to the use of negative terms attached to questions involving positive the notion about a phenomenon and vice verse. Alternatively, double vision could be included by dangling alternatives, which means that first the question is asked and then the answer options are given. Another important aspect to be kept in mind is that (5) the tasks or items are manageable, meaning that they are clear to a survey's subjects; it is important to distinguish between facts and attitudes or at least to distinguish between items for which subjective or factual answers are expected. This goes along with principles number one and two since definitions must be shared by scholar and subjects ensuring that both are talking about the same definition of an object or phenomenon, say a family; this might be ensured by giving examples. Finally, the difficult balance has to be found for (6) giving enough information for complex tasks, but sticking to the principles concerning simplicity (Converse and Presser 1986).

On the following pages, the measures used in collecting data are presented in some detail; these are measures of (a) reference information on the study's participants, (b) opportunity recognition, (c) problem construction, (d) information encoding, (e) category selection, and (f) category combination and reorganisation.

Besides the measures with which the individual differences in processing information are assessed some other (a) reference information about participants of the study were collected. To start with, subjects were asked for their age and sex; however, the actual interest was to learn more about two relevant dimensions, for which homogeneity was regarded necessary: (1) Each individual's level of knowledge in relevant domains and (2) their intention or motivation to start a business or recognise entrepreneurial opportunities. Main intend was the methodological necessity to have a sufficiently homogenous sample in relevant dimensions that allows to trace back differences in the dependent variable of opportunity recognition to information processing differences as causing effects or variables. The impact the level of knowledge and expertise in a domain can have on information processing has been emphasised throughout the entire present work and from a methodological point of view particularly in chapter III.A. Therefore, it seemed reasonable to assess some indicators in order to control data for different levels of knowledge.

However, in the context of opportunity recognition it could be distinguished between levels of knowledge for entrepreneurship and starting a business on the one hand, and the specific domain, e.g. industry, technology, or simply the general field, the individual is situated in on the other hand. In order to collect data on subjects' knowledge on business, entrepreneurship, and starting a business they were asked four questions: (1) How many semesters they had studied courses in business at university at the moment of the survey, (2) how many semesters they had studied courses in entrepreneurship at the moment of the survey, (3) if they had already started a business at the moment of the survey, and (4) if someone in their family (parents, brothers or sisters) has ever started a business? In order to control for relevant knowledge in a specific domain, subjects were asked for experience they had accumulated in the fields the two situations for measuring opportunity recognition in the present study. As will be shown later, the two questions were, firstly, about experience in or knowledge about culture and economy of a foreign country they spent some time in, and, secondly, on experience in or knowledge about mechanical engineering or production and fabrication of metal.

Question	Answer Options
Knowledge in entrepreneurship	
How many semesters have studied courses in business at university?	*metric*
How many semesters have you studied courses in entrepreneurship?	*metric*
Have you already started a business?	*Yes; no*
Has someone in your family (parents, brothers or sisters) has ever started a business?	*Yes; no*
Knowledge in Relevant Domains	
Have you spend some time in a foreign country, e.g. doing a period of study or internship, etc.?	*yes, more than a year; yes, between 6 months and a year; yes, between 0 and 6 months; no*
How much knowledge or experience in the field of producing or fabrication of metals or mechanical engineering in general do you have?	*very good (expert); good (dealt with it many times); average (dealt with it several times); little (dealt with it from time to time);practically nothing (only heard about it); nothing*
Entrepreneurial Motivation	
How likely is it that you are going to start a business during studies?	*(already started; very likely (concrete plans); rather likely; rather unlikely; very unlikely; impossible)*
How likely is it that you are going to start a business within 5 years after graduation?	*(will definitely start a business; very likely (concrete plans); rather likely; rather unlikely; very unlikely; impossible)*
How likely is it that you are going to start a business within 10 years after graduation?	*(will definitely start a business; very likely (concrete plans); rather likely; rather unlikely; very unlikely; impossible)*

Figure 44 Question Items for Reference Measures.

The statement that an economic agent's motivation to start a business should be controlled for can be inferred from a general psychological perspective since it has been shown in chapter III.C.3 that motivational or affective aspects strongly influence human information processing and from literature in the field of entrepreneurship dedicated to the role of entrepreneurial motivation (see for an overview Shane et al. 2003). However participants were asked how they would rate the probability to start their own business (1) already during their studies, (2) within five years after graduation, and (3) within ten years after graduation? All items that subjects were asked for as reference measures are shown in Figure 44.

Conceiving an appropriate (b) measure of opportunity recognition seems to be one of the most demanding tasks for scholars doing research on the phenomenon: Many problems have already been mentioned related to the operationalisation of the ability to recognise entrepreneurial opportunities. This construct or concept is difficult to measure, particularly because an opportunity is generally evaluated ex-post. This means that the market response is evaluated and, for instance, judged if it has been a rather incremental or revolutionary innovation. But in fact it is crucial to capture the process of finding an innovative idea for a product or service itself and not the market response to develop useful theories about opportunity identification and shaping. In addition, it has been pointed out that entrepreneurial opportunities are of subjective nature, at least from a cognitive perspective. This is definitely problematic for a measure's validity and reliability.

This objection can be attenuated by obtaining expert opinions from acknowledged and reputable experts (Gaglio 2004). But still, scholars might feel uncomfortable with the subjective nature of the measure: Nevertheless, it has to be admitted that opportunities are subjective at least if a cognitive perspective is assumed. In other words: "Because of the social nature of knowledge and information used to create innovation, it is impossible to suggest that reliance on subjective measures could diminish over time. One can only point to the recent advances in innovation research, which depend on these kinds of subjective measures, and hypothesise a similar outcome for entrepreneurship." (Gaglio 2004, p. 130)

In this sense it is relevant what other economic agents, i.e. customers, think whether they are facing an opportunity since this is the relevant factor when it comes to the acquisition of customers. From this point of view, there is no entrepreneurial opportunity as long as other economic agents are not convinced of the opposite. Consequently, it seems possible that a panel of appropriate judges is able to rate an individual's idea, problem solution, or option of action conceived for a particular situation as to the dimension whether it might be an entrepreneurial opportunity or not. Accordingly, in the present work a panel of seven judges rated the solutions given by subjects as to their personal conviction whether participants had been able to recognise an entrepreneurial opportunity for each of the two economic situations given. The judges were asked to provide a rating between zero and five for the quality and originality of a subject in the two problem situations, so that from each judge four ratings were obtained as to the answers of the individuals in the sample. The idea to ask for a judge's opinion as to the dimensions of quality and originality stems from general research on creative thinking (Mumford et al. 1996a, b, c, 1997). To ask only for two ratings per subject and situation was chosen since it ought to keep effort and complexity manageable for judges. However, the judges were provided with the definitions of the concepts of quality and originality in the context of entrepreneurial opportunities; those were drawn from the definition and characteristics of an entrepreneurial opportunity as has been outlined in chapter II.C.1 and general definitions of quality and originality of problem solutions in research on creative thinking; these are shown in Figure 45.

All seven judges can be regarded as experts on entrepreneurial opportunities since doing research on entrepreneurship and having acquired experience in consulting start-ups. Indeed they highly agreed on the quality and originality of answers; this has been assessed by calculating interrater agreement coefficients (ICC), which can be interpreted as reliability across all judges for an indicator (Shrout and Fleiss 1979). A general definition of the ICC would say that it expresses "[…] the correlation between one measurement (either a single rating or a mean of several ratings) on a target and another measurement obtained on that target." (Shrout and Fleiss 1979, p. 422) Generally, in statistic terms reliability is an indicator for the consistency of a set of measurements or a measuring instrument. This means that an experiment's reliability is the extent to which the measurements remain consistent over repeated heats under identical experimental conditions. Hence, an experiment is regarded reliable if it yields consistent results of the same measure. Such reliability is of particular interest in experimental situations, in which judges subjectively evaluate phenomena: their ratings are often assumed to be subject to measurement error (Yaffee 1998).

However, the ontological discussion entailed will not be treated here in detail, but it should be considered that such reliability has a different meaning in a relativistic and realistic view: Assuming the latter, the term of measurement error seems appropriate because there is an objective phenomenon at hand, which can be accurately and correctly observed by different judges. Therefore, reliability is an indicator of accurate measurement, i.e. the quality of reality's measurement, by the group of subjects measuring a phenomenon under observation. In a constructivist view reliability does not refer to quality but a measure of agreement.

The phenomenon at hand has no 'real' score or attribute that can be accurately observed or measured. Rather reliability only says something about the similarity of construction between subjects. Assuming a cognitive constructivist perspective in the present work the reliability measures presented in the following should be consequently understood as measures, to which degree the judges agreed on a measurement or scale. However, there exist different possible coefficients with which rater reliability can be measured, but textbooks generally only present one or two forms. Since different use of such coefficients leads to different results, and, therefore, affects statistical analysis and interpretation, it is important to identify the most appropriate intraclass correlation coefficient (ICC).

It would simply be too much and not really valuable to present all the different versions of the ICC in the present work. In case that in a study each target - the answers given in the present study - is rated by each of the same *k*- judges, which represent the totality of judges, the most appropriate measure is the so called ICC (3, *k*) since the *k*- judges are considered as fixed effects, which is referred to as case 3 (Shrout and Fleiss 1979). This means that targets (the scores of the variables) are deemed random, but the judges asked for their rating are the only ones of interest; this is known as the two-way mixed model. However, for any type of ICC two versions of reliability exist, depending on whether the unit of analysis is the individual rating of each judge or the mean of all the ratings (Yaffee 1998). In the present work the latter case applies, reason why those of type ICC (3, *k*) from the set of different kinds of intraclass correlation reliability coefficients are chosen for the present work. This measure is equal to Cronbach’s alpha that is introduced in chapter V.C.1, reason why the exact calculation is only presented there. As shown in Table 1, the ratings of the seven members of the panel evaluating answers given in opportunity recognition situations all produce agreement coefficients of 0.762 or higher, which is acceptable.

Situation	Variable	ICC (3, 7)
1	Quality	0.827
1	Originality	0.908
2	Quality	0.762
2	Originality	0.792

Table 1 ICCs for Opportunity Recognition Items.

More precisely, it was assumed that the above mentioned information-processes are applied in coming to a problem solution and individual differences might account for variance in quality and originality of answers given. Subjects were asked to suggest one- or two-paragraph solutions to two complex, realistic, and novel economic problems. They were told that the author believed there might exist different entrepreneurial opportunities in the situation described. Furthermore they were asked to give away their ideas on how to realize a profit in this particular situation. In particular, subjects were hold up to name their problem solution, how they would transform this into a marketable product or service, which major customer groups they would target, and if they could think of any particular USP of their solution.

Construct : Ability of Opportunity Recognition		
Indicators	**Rating**	**Definition (Criteria)**
Quality of Problem Solution in Situation	Between 0 and 5 (5 → I totally agree 0 → I totally disagree)	***General aspects*** **Completeness**: Did the subject understand the instructions, used the information, and followed the instructions fully and completely? **Effectiveness**: is the plan usable, practical, or appropriate (reach and frequency)? ***Specific Aspects*** **Economic value**: Does the plan promise to yield a profit? Creating new wealth: Does the plan provide the subject with idiosyncratic advantages resulting from specific knowledge? **Perceived desirability**: Does the plan meet the general social and ethical requirements it is embedded is?
Originality of Problem Solution Situation 1 2	Between 0 and 5 (5 → I totally agree 0 → I totally disagree)	***General aspects*** **Unexpectedness**: Did the subject approach the problem in a novel imaginative, unpredictable, or innovative manner? **Description**: Did the subject expand upon an idea, tell as story, or use fine detail to help the reader visualise the plan? ***Specific Aspects*** **Novelty**: Does the problem solution represent something new or novel? **Uniqueness**: Is the problem solution easy to imitate?

Figure 45 Criteria for Judging Ability of Recognising Entrepreneurial Opportunities.

The two tasks used in the present study were somehow different in their underlying nature, thereby, accounting for the insight that the nexus between individual and opportunity is of crucial impact in entrepreneurship. The first problem situation was based on Shane (2000), who described how eight entrepreneurs discover different opportunities for new businesses, exploiting the same technological invention. The idea behind selecting this particular case and describing the technology to participants of the present study was that judges could be provided with further information about which opportunities turned out to be successful and generated high profits, thereby, potentially increasing the quality of their judgement.

Notwithstanding the advantages of such a well discussed case, it had been likely that most of the young business students participating in the study had never accumulated any experience in the field and might have low levels of affect or motivation in this field. Therefore, the second situation was intended to be more realistic to participants, aimed at resulting in a higher level of involvement. Further to this, the second situation was different to the first in that it had nothing to do with a technology; this also implied that, while the former was rather supply-driven, the second situation rather called for demand-driven opportunities. However, both economic situations presented to the subjects, highlighting their capability of opportunity recognition, are shown in Figure 46.

Situation 1
While attending an interdisciplinary seminar on entrepreneurship at university you built up close relationships to engineers, who have recently been granted a patent for one of their projects, the 3DP™ technology. 3DP™ stands for three-dimensional printing for producing a variety of components; this technology allows to bring a malleable mass, comparable to powder, into almost any three-dimensional form and cure it with a special kind of glue. Excessive powder can be easily removed and reused. By calcinations and further procedures strength of the object produced can be increased significantly, resulting in solid and durable final products. *The engineers emphasised their conviction that the technology's possibilities of application are almost infinite: actually, each three-dimensional form can be produced at any level of robustness. However, the engineers are technology-focussed and do not care so much about the practical use and marketisation of 3DP™. This is the reason why they approach you; after all you attended different courses on starting-up a business.*
Situation 2
Until recently you spend an academic year as visiting student at a university in a foreign country. Since you felt very well over there and knew the language quite well at the end of your studies, you prolonged your stay and did an internship in a company in the same city for a couple of months. Your decision really made sense, considering that this country's economy is one of the most important trade partners of your home country. *Back in your home country, you are reflecting about your experiences concerning your stay in the other country; quite striking was the significant difference in prices levels for virtually all products and services. Further to this, labour costs seem are lower in the other country, notwithstanding that labour force seems to be comparably qualified.* *Probably even more important, you realised that within the rather short time in this country, you were able to build up an interesting social network with business people, entrepreneurs, etc., all showing high interest in your country and probably doing business with you.*
Question: *Do you have any idea how to make a profit in this situation? Please do sketch a market solution (product, service, etc.) and name potential customers. What would be particular about your solution (its unique selling proposition, USP)?*

Figure 46 Economic Problems for Assessing Opportunity Recognition.

The (c) measure for preferences for applying different types of representational elements in the process of problem construction was developed on the idea of Mumford et al. (1996a). They were assessed by presenting four problems to each subject. Each problem was presented in a short statement describing a complex situation, which were conceived in such a manner that the problem subjectively perceived could be defined in a number of different ways. After reading through the initial statement, subjects were confronted with sixteen alternative redefinitions or restatements of the problem and asked to select the two restatements they thought might be most useful in coping with the situation given (see appendix). In order to assess preferences for representational elements or types of information in defining and structuring complex, ambiguous situations each of the sixteen restatements were explicitly generated to reflect the use of a certain type of information. Therefore, the sixteen alternatives presented to the subjects in random order consisted of four statements describing (1) key diagnostic information, (2) goals, (3) procedures, and (4) restrictions or constraints respectively.

Several procedures were applied to ensure that each restatement included in the set of the sixteen has a certain degree of validity in representing a type of information; the set of restatements included in the survey for each problem situation was generated in the following manner: The problem situation was presented to a panel of three members. Each member was asked to generate sixteen alternative restatements with the restriction that four statements are based on (1) key diagnostic information, (2) goals, (3) procedures, and (4) restrictions respectively. This set or pool of alternatives was presented to ten further judges who built up a second panel, asked to rate the degree to which each of the 48 redefinitions produced by the fist panel is based on each type of information from their personal point of view, each alternative on a five-point scale. The ratings of this second panel for the different situations or tasks, shown in Table 2, all produce ICC scores of 0.927 or higher, which indicates an extremely high reliability of the measures since the judges agreed on the scale values of statements to a high extent.

Situation	ICC (3, 3)
1	0.927
2	0.933
3	0.927
4	0.945

Table 2 ICCs for Problem Construction Items.

These ratings allowed identifying alternatives of the initial set or pool that had strongly represented representational characteristics (e.g. goals) or types of information and low ones for the others (e.g. information, procedures, and restrictions). This information allowed selecting four alternative redefinitions for each information type to be included in the actual survey. Hence, subject's individual scores for testing preferences regarding different types of information could then be obtained by counting the number of times subjects decided to use definitions across all four problem situations they were confronted with (Mumford et al. 1996a).

Figure 47 indicates which data as to the process of problem construction has been generated for each subject EA_j in the survey; it is counted how often a subject has selected a redefinition, which represents a specific type of information. The numbers in the cells are the number of times a subject has selected a restatement representing each type of information across all four situations; these sum up to eight for each individual. The relative weights could be interpreted as preference for a type of information. It should be noted that this methodological proceeding implies that the preferences are not independent but negatively correlated.

	Goals TI^G	**Constraints** TI^C	**Actions** TI^A	**Information** TI^I	**Sum**
EA_j	2	3	1	2	8
	Goals $g_{t,j,k}^{PC}$	**Constraints** $i_{t,j,k}^{PC}$	**Actions** $a_{t,j,k}^{PC}$	**Information** $c_{t,j,k}^{PC}$	
EA_j	0.25	0.375	0.125	0.25	1

Figure 47 Process-based Measures for Problem Construction for Each Economic Agent.

The four situations in the general problem-solving domain were taken from the original study (Mumford et al. 1996a) and translated into German. The four situations in an entrepreneurial context were conceived for the present work, based on realistic experiences that could be gathered in consulting start-ups in a regional start-up promotion network (see for the tasks and respective redefinition or restatements included in the final survey the appendix).

Preferences in kinds of (d) information attended to during information encoding were assessed, again, by presenting four problems to subjects (Mumford et al. 1996b). For each situation they were asked to read a first, initial description of the novel, ill-defined problem, which was specified by six short additional statements of information bearing on the respective problem. Based on this information the participants of the survey were asked to give a one- or two-paragraph solution to each problem. Each chunk of information for each problem situation or task (one initial problem description, six additional statements of information, one answer frame, altogether eight) was presented on a single page, which allowed assessing the time spent on each page or part of the task independently. Subjects were allowed paging back to a given page as often as desired in order to generate a solution. An individual’s preference for certain types of information could be assessed by manipulating the additional information given (see appendix).

In all four problem situations the third, fourth, and fifth page presented key factual information seemingly necessary to solve the problem at hand. The remaining information on the first, second, and sixth page was manipulated to reflect other types of information: In two of the four tasks the first page presented additional factual information, the second page information apparently irrelevant to solving the problem at hand, and, on the sixth page, principles that might be useful in generating a solution. The remaining tasks contained on the first page goals needed to be addressed in solving the problem, on the second page less relevant issues, which, albeit pertinent to grasping the situation, seemed not essential for generating a solution, and on the sixth page, restrictions or constraints that might be worth being considered in solving the problem.

Again, the information included was selected inter-subjectively in a similar process as already outlined for the problem construction-measure: A first panel of three individuals was asked to produce statements they regard to belong to the seven types of information included: (1) relevant factual information, (2) additional contradictory information, (3) information apparently irrelevant to solving the problem at hand, (4) principles, (5) goals, (6) less relevant issues, and (7) restrictions or constraints for each problem situation. The second panel, consisting of ten individuals, then rated independently on a scale from zero to five whether they personally thought a statement given belonged to the type of information it was originally conceived for by the first panel (see for the interrater agreement in the second panel Table 3). For each situation those statements were included in the survey that received the highest average score in the ratings of the second panel.

Situation	Domain	ICCs (3, 10)
1	General	0.674
2	General	0.859
3	General	0.709
4	General	0.723
5	Entrepreneurship	0.698
6	Entrepreneurship	0.769
7	Entrepreneurship	0.692
8	Entrepreneurship	0.731

Table 3 ICCs for Information Encoding Items.

The actual measure or indicator of personal preferences in encoding information was then obtained by assessing a relative-time-spent measure (*RTS*) of the time spent by subjects examining a type of information. The idea behind this measure is that individuals must, due to limited processing capacity, direct attention to particular cues in the external world. By comparing the relative time spent on information of a particular type, individual’s preference should be uncovered in the sense that some information types are more attended to than others.

To start with, since each chunk of information was presented on a single page and subjects were allowed browsing through each task, total time spent examining each page was identified. Then, for each problem relative time spent on a page was calculated by dividing the absolute time spent on a page by the total of absolute time spent on encoding information in a task. These *RTS* for each type of information *TI* were then averaged over all $l = 4$ problem tasks. By dividing this measure for each type of information by the sum of all these measures, an overall or average relative-time-spent score *(ARTS)* for each information type was obtained. More formally, the average relative time spent on one type of information was calculated by dividing the sum of relative-time-spent-measures for each situation by the cardinality of this set of measures:

$$ARTS^{TI} = \frac{\sum_{K=1}^{l} RTS_k^{TI}}{l}$$

Put more formally, relative time-spent for a type of information in a problem situation was calculated by the absolute time spent on pages of an information type divided by the sum of time spent on all types of information in this situation divided by the numbers of pages containing such information in this situation:

$$RTS_k^{TI} = \frac{TS_k^{TI}}{\sum_{TI=1}^{r} TS_k^{TI}} \cdot \frac{1}{P_k^{TI}}$$

with: TS_k^{TI} = Absolute time spent on information type *TI* in situation *k*.

P_k^{TI} = Number of pages containing information type *TI* in situation *k*.

r = Total number of information types included.

This information on each participant EA_j of the study for the process of information encoding are shown in Figure 48.

$ARTS^{TI}$ in %	Relevant Information TI^{RI}	Contradictory Information TI^{CI}	Irrelevant Information TI^{II}	Principles TI^{P}	Objectives TI^{G}	Less relevant Information TI^{LRI}	Constraints TI^{C}	*Sum*
EA_j	19	13	15	13	21	9	10	100

Figure 48 Process-based Measures for Information Encoding for Each Economic Agent.

In order to generate a (e) measure of the kind of information serving as central base on which individuals tend to select or activate extant knowledge categories, a process here called category selection, subjects were confronted with five different problems; the whole procedure for generating this measure resembles to those for assessing problem construction and information encoding. Each of these problems was briefly described in a three- or four-paragraph description. All the problems presented to subjects - five for the general and entrepreneurial setting respectively - were taken from Shorris (1981), a book describing real-world economic problems, and were presented in such a manner that the problems were ill-defined and allowed for generating many different, albeit viable, solutions based on an array of different categories or concepts (Mumford et al. 1996c). After reading through a problem description subjects were presented eight concept statements that seemed useful in understanding the situation and generating a potential solution to it (see appendix).

From these eight they were asked to select the four statements they were convinced would be most appropriate in understanding the situation and solving the problem. Each of these concept statements reflected a different category or conceptual framework; two of the statements described concepts based on (1) general principles, (2) long-term goals, (3) evaluation of others (social peering), and (4) discrete action plans respectively. Data assessed for each subject are shown in Figure 49.

	Long-term Goals TI^G	**General Principles** TI^P	**Discrete Action Plans** TI^A	**Evaluation of Others** TI^S	**Sum**
EA_j	5	4	4	7	20
	Long-term Goals $g_{t,j,k}^{CS}$	**General Principles** $p_{t,j,k}^{CS}$	**Discrete Action Plans** $a_{t,j,k}^{CS}$	**Evaluation of Others** $s_{t,j,k}^{CS}$	**Sum**
EA_j	0.25	0.2	0.2	0.35	1

Figure 49 Process-based Measures for Category Selection for Each Economic Agent.

Similar procedures to those in developing the problem-construction-measure were applied to guarantee inter-subjective validity of the concept statements used as representatives of types of information: A first panel of three individuals produced a pool of ten to twelve statements for each information type and each problem situation. These were evaluated by a second panel, consisting of ten members, with ratings from zero to five; high ratings suggesting that panel II-members agreed with panel 1-members' conviction that the respective statement is representative for a type of information. For each problem and information type, based on these evaluations, the two statements showing the highest ratings were included in the final survey task and randomly ordered. This proceeding was necessary for only nine situations since one problem and the corresponding answer alternatives could be adopted from a study by Mumford et al. (1996c). The ratings of this second panel for the nine situations developed all produced interrater agreement coefficients higher than 0.5; if situation 7 and 9 are excluded even 0.67 and higher (see Table 4).

Situation	Domain	ICCs (3, 10)
1	General	0.765
2	General	0.859
3	General	0.764
4	General	0.668
5	Entrepreneurship	0.729
6	Entrepreneurship	0.809
7	Entrepreneurship	0.560
8	Entrepreneurship	0.691
9	Entrepreneurship	0.534

Table 4 ICCs for Category Selection Items.

The ten problem situations and the selected concept statements for the four information types are presented in the appendix. On this basis, category-selection-scores could be obtained by counting the number of times subjects chose a particular type of concepts bearing on general principles, long-term goals, evaluations of others, or actions plans. Concluding, the maximum score achievable for each information-type-concept was ten since subjects could choose two of a type in five tasks at most.

As has been said in chapter IV.C.1 it is assumed that individuals have a regulatory focus that particularly guides their initial information processing, including problem construction, information encoding, and category selection. According to previous research in cognitive psychology on creative thinking already touched, the preference type of promotion style as constructs is measured by the preferences for goals in problem construction, information encoding, and category selection, while a prevention style is as shown measured by the preferences for goals in problem construction and information encoding; the constructs' measurement is shown in Figure 50.

Construct	Definition	Scores
Promotion Style		
TI^G	Preference for Objectives in Problem Construction	0-8
	Preference for Objectives in Information Encoding	0-100
	Preference for Objectives in Category Selection	0-20
Prevention Style		
TI^C	Preference for Constraints in Problem Construction	0-8
	Preference for Constraints in Information Encoding	0-100

Figure 50 Operationalisation of Promotion and Prevention Style of Regulatory Focus.

The design for the (f) measure used to assess category combination and reorganisation was based on a method developed by Mobley et al. (1992). The measurement for this process was designed differently to those dealt with before since it is not a preference- but a capability-indicator. However, subjects participating in the study were confronted with four situations; in each, three categories or concepts were given to them. However, in order to avoid verbal planning these categories were not named or labelled, but only defined by four typical exemplars of the relevant categories, (Mumford et al. 1997); one of the tasks included in the survey is shown in Figure 51.

Category 1: Chair; Couch; Lamp; Picture;
Category 2: Wheel; Seat; Steering Wheel: Brakes;
Category 3: Mars; Jupiter; Earth; Venus;

Figure 51 Example for Category Combination and Reorganisation Task.

The categories and category exemplars used were all artificial since findings indicate that those show a greater flexibility than biological categories, thus, apparently providing a superior indicator for individual differences (Mobley et al. 1992). The four tasks and the respective twelve categories in the general setting were taken from the study of Mobley et al. (1992). The four tasks in the entrepreneurial setting were developed for the present study, based on the same requirements that led to such categories and exemplars in the above mentioned studies.

Subjects participating in the study were then asked to read through the list of exemplars, defining the three categories on a given task. They were then requested to combine these three categories into a new category, accounting for all twelve presented exemplars, and find a label for this new category. Further to the (1) label, they were asked to find a (2) brief, one-sentence description of the category, (3) to list as many additional exemplars or members of the new category they can think of, and, finally, (4) to name as much emergence features for the new category, that is list as much additional features tying together the exemplars included in the new category (see appendix). The actual measure for each subject was obtained by a panel of three judges, who were asked to give one rating (between 0 and 5) for the quality and originality of the new category developed and the respective descriptions provided by participants on a given task; the instructions to judge the responses given are shown in Figure 52.

Construct : Ability of Category Combination and Reorganisation		
Indicators	**Rating**	**Definition (Criteria)**
Mean Quality of Category Recombinations in Situations 1 to 4	Between 0 and 5: 5 → high 0 → low	***General aspects*** **Completeness**: Did the subject understand the instructions, used the information, and followed the instructions fully and completely?
Mean Originality of Category Recombinations in Situations 1 to 4	Between 0 and 5: 5 → high 0 → low	***General aspects*** **Unexpectedness**: Did the subject approach the problem in a novel imaginative, unpredictable, or innovative manner? **Description**: Did the subject expand upon an idea, tell as story, or use fine detail to help the reader visualise the plan?

Figure 52 Criteria for Evaluating Ability of Category Combination and Reorganisation.

Overall quality and originality of the new category conceived, represented by label, one-sentence description, additional exemplars and emergent features were the same as for the problem-construction measure. The experts were all psychologists familiar with the fields of cognition and creative thinking; additionally, they were briefed as to the definitions of quality and originality in the present context (Mumford et al. 1997). The interrater agreement coefficients for these judges and their ratings on the answers given in the four category combination and reorganisation tasks are shown in Table 5.[xxxi]

Domain	Situation	ICC (3, 3)
Entrepreneurship	1	.364
	2	.283
	3	.364
	4	.345
General	1	.355
	2	.365
	3	.310
	4	.388

Table 5 ICCs for Category Combination and Reorganisation Items.

B. Causal Analysis and Structural Equation Models

1. Basic Ideas and Purposes

Generally, causal analysis is a holistic approach for theory testing, controlling for measurement errors and possible testing of complex networks of statements (Bagozzi 1984). Depending on the historical or intellectual antecedents, causal analysis may also be called structural equation modelling (SEM), covariance-structure analysis, or linear structural relations-approach (LISREL). Indeed, the use of the term causal analysis is somehow problematic in scientific terms, since it might be objected that causality can only be tested in experimental settings; notwithstanding since most prominent and rarely criticised in the literature, the term is used hereafter (Homburg and Hildebrandt 1998). The term of structural equation models is used synonymously in the present work because such describe a causal model mathematically.

In effect, this tool offers many possibilities of analysis others cannot, e.g. it is not only possible to consider random errors like in usual regression analysis, but also to dissect variances and covariances of manifest variables into components that can be attributed to different factors and other components that represent random errors by using factor models. Simultaneously the method still permits tests for classical validation concepts. Therefore, some scholars even argue that it might be the best available method in the social sciences for theory testing since it allows for a more rigorous test of formalised theories than usual bivariate or multivariate statistics for testing causal relations (Homburg and Hildebrandt 1998). Causal models are built to investigate or analyse causal dependencies that have been inferred by the researcher beforehand, as indicated in the general description of the research process, on basis of the existing body of theory. Thus, they have a rather confirmatory character since an ex-ante theoretical system of hypotheses is analysed on basis of empirically generated data.

Particular about this method is that relations between empirically unobservable, so called latent variables can be analysed. Latent variables are hypothetical constructs that cannot be observed and measured directly in the empirical world. In terminology of causal analysis, therefore, they are denominated with Greek small letters and drawn in circle, while observable variables are put in Latin small letters and drawn in rectangles. Put differently, hypothetical constructs are characterised by abstract contents, for which cannot be imminently decided, whether the statement given by the superordinate system of hypotheses holds true in reality or not (i.e. image, intelligence, creativity, etc.). Hence, a construct might be defined as ”[…] a conceptual term used to describe a phenomenon of theoretical interest” (Edwards and Bagozzi 2000, p. 156-157). Alternatively it might be seen as “[…] an abstract entity which represents the ‘true’, non-observable state or nature of a phenomenon.” (Bagozzi and Phillips 1982, p. 24) It should be quite apparent that causal analytic models realise the general idea that has been outlined for research in general by generating less abstract, measurable hypotheses that can serve as representations for more abstract ones; causal analytic models exactly allow to investigate such rather abstract constructs by their operationalisation, i.e. to find appropriate measures or indicators, also called manifest variables (Homburg and Hildebrandt 1998).

Altogether, four general purposes can be identified for which causal analysis can be applied, of which the first two have already been mentioned as central idea of the whole method: construct validation of the measurement models and test of hypotheses structures by the structural model. Further to this, causal analysis can also be applied to execute multiple group comparisons by testing averages and applied as an exploratory instrument for detecting structures (Homburg and Hildebrandt 1998). However, only the first two functions are applied in the present work.

Obviously this data analysis model seems to be most appropriate to the present research objectives; in particular it is possible to explicitly test for causal relations between hypothetical constructs, such as the two regulatory focus styles, category combination and reorganisation, opportunity recognition. In a nutshell, the basic idea of causal analysis and structural equation models is to define one or more indicators (manifest variables) for each latent variable or hypothetical construct in order to analyse the relationships between the latter. However, in causal analysis latent variables that ought to be explained, i.e. dependent variables, are called endogenous, while explaining, independent variables are called exogenous.

It follows that a complete structural equation model consists of a structural model describing relations between hypothetical constructs and two measurement models; one for latent exogenous variables and one for latent endogenous variables. Empirical data on indicator variables then allows calculating covariances and correlations between them. These can serve to analyse the relations between latent variables and their indicators, allowing to determine (1) validity of indicators for measuring a hypothetical construct (Homburg and Giering 1996), and (2), secondly, analyse the relations between latent endogenous and latent exogenous variables in the structural model. These two aspects equal to the ideas of factor and regression analysis. In fact, the method is a combination of factor analysis for testing operational hypothesis and a structural equation model for testing general hypotheses on the level of hypothetical constructs. The path diagram usually used for depicturing represents all underlying measurements and causal hypotheses, which are formalised for estimations. The starting point of causal analysis is, therefore, not the initial data matrix observed in the field, but the respective covariance matrix or correlations. Put differently, structural equation models analyse data on an aggregate level and test a system of hypotheses as a whole (Homburg and Hildebrandt 1998).

2. Causality and its Testing in Structural Equation Models

Since causality is tested some basic concepts and terms are briefly repeated in the following that are crucial for the approach chosen. However, the concept of causality cannot be discussed in detail because it is a whole research topic of its own (see e.g. Hellevik 1984; Pearl 2000). Nevertheless, it should be noted that such models are always proxies, i.e. incomplete and simplified: Statements and explanations always only refer to the model structure at hand. Furthermore, a causal model has an inherent preliminary character since it cannot be rejected or confirmed by underlying data. The method, like any other multivariate method, only tests statements whether a causal relation, developed on basis of exploratory assumptions of the researcher at work, statistically exists or not. This means that causal conclusions must be based on criteria beyond the system of data analysis (Homburg and Hildebrandt 1998).

In the present work, causality is regarded to prevail between two variables x_1 and x_2, if variable x_1 is a direct cause of x_2 *(written as* $x_1 \rightarrow x_2$*)*; i.e. if a change in x_2 is caused by a change in x_1, while all other variables that do not depend on x_2 are held constant in a causal model (Hodapp 1984). It is exactly this control problem that makes causal analysis so difficult since actually only experimental situations can control for relevant variables and are able to identify the effect a single independent variable has on the dependent variable (Hellevik 1984); due to this, parsimony is critical to scientific inquiry.

Therefore, researchers in the IPP usually try to dissect complex behaviours into simpler component stages. Hence, such research is less daunted than other psychological approaches by behavioural variability because it attends to information and information processing of component stages rather than to global behaviours (Massaro and Cowan 1993). This dissection into several process-based measures is also intended in the present work, as a potential starting point for more fine-grained research on cognitive processes in opportunity recognition. However, in the present work it is assumed that a relation can be formally expressed through covariance and correlation between two variables. The empirical covariance $s(x_1,x_2)$ between x_1 and x_2 is defined as:

$$s\left(x_1, x_2\right) = \frac{1}{K-1} \sum_k \left(x_{k1} - \overline{x_1}\right) \cdot \left(x_{k2} - \overline{x_2}\right)$$

With: x_{k1} = Score of variable 1 for object k.
$\overline{x_1}$ = Mean of scores of variable 1 across all objects $k = 1, \ldots, K$.
x_{k2} = Score of variable 2 for of object k.
$\overline{x_2}$ = Mean of scores of variable 2 across all objects $k = 1, \ldots, K$.

An empirical covariance of approximately zero suggests that no linear dependence exists between x_1 and x_2, i.e. they are not found together more often (their contingency is not higher) than chance would predict. In turn, a covariance smaller or larger than zero indicates that both variables' scores develop more frequently in the same direction (positive) or in opposite directions (negative) than statistic chance would suggest. However, covariance solely cannot tell much about the strength and direction of the relationship between x_1 and x_2; in order to gain information about the strength of the relationship, covariance is standardised on an interval, transforming it into an indicator that can give a statement about the strength of the relation. Standardisation is obtained by dividing covariance by both variables' standard deviation, resulting in the correlation coefficient r_{x_1,x_2} of x_1 and x_2.

$$r_{x_1,x_2} = \frac{s\left(x_1, x_2\right)}{s_{x_1} \cdot s_{x_2}}$$

with: $s\left(x_1, x_2\right)$ = Covariance between x_1 and x_2
s_{x_1} = $\sqrt{\frac{1}{K-1} \sum_k \left(x_{k1} - \overline{x_1}\right)^2}$ Standard deviation of variable x_1
s_{x_2} = $\sqrt{\frac{1}{K-1} \sum_k \left(x_{k2} - \overline{x_2}\right)^2}$ Standard deviation of variable x_2

Apparently, such a standardised indicator can adopt scores between -1 and +1; the closer its absolute score approaches 1, the larger is the dependence of the two variables, while a correlation coefficient close to zero suggests independent variables. Although such an indicator can state something about the strength of relation, it cannot tell anything about the question, which variable is actually causing the other; a question for which, generally, four possible interpretations exist. The first two are both named a causally interpreted correlation since an unambiguous direction of causality can be assumed: These are the cases in which variable x_1 is causing the score of variable x_2 ($x_1 \rightarrow x_2$), or, vice versa, variable x_2 is causing the score of variable x_1 ($x_2 \rightarrow x_1$). Thirdly, it might be the case that variables x_1 and x_2 are partially explained by the influence of an exogenous (hypothetical) cause or factor ξ (read: Ksi) underlying the two variables. If so, the calculated correlation between x_1 and x_2 is only partially interpretable causally since x_2 (in this example) is not only directly influenced by variable x_1, but also in two ways by the hypothetical cause or factor ξ_1 that alters variable x_2 directly and, in addition, indirectly via x_1 as depicted in Figure 53.

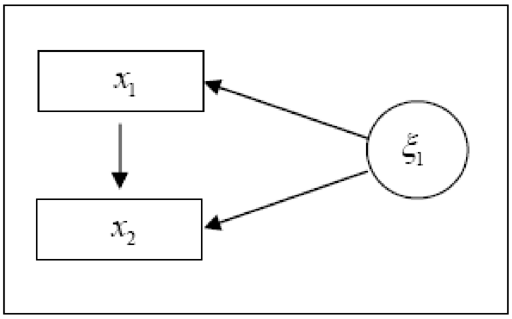

Figure 53 Causal Interpretation of Variable Relationships.

Finally, a correlation cannot be interpreted causally if the relationship between variables x_1 and x_2 only results from an underlying exogenous (hypothetical) cause or factor ξ_1 (this would mean graphically that the arrow between x_1 and x_2 in Figure 53 would have to be deleted). This last possible interpretation can be examined by testing if the correlation between x_1 and x_2 is really zero in case ξ_1 is held constant, i.e. the influence of ξ_1 is eliminated. This can be tested by using partial correlation coefficients; considering the example given, three correlations could be identified $\left(r_{x_1,x_2}; r_{x_1,\xi}; r_{x_2,\xi}\right)$, represented by the three arrows in Figure 53. Generally, the partial correlation coefficient for x_1 and x_2 while keeping ξ constant can be calculated in the following manner:

$$r_{x_1,x_2\cdot\xi} = \frac{r_{x_1,x_2} - r_{x_1,\xi}\cdot r_{x_2,\xi}}{\sqrt{\left(1-r_{x_1,\xi}{}^2\right)\cdot\left(1-r_{x_2,\xi}{}^2\right)}}$$

with:

$r_{x_1,x_2\cdot\xi} =$	Partial correlation coefficient between x_1 and x_2 eliminating the influence of ξ
$r_{x_1,x_2} =$	correlation coefficient between x_1 and x_2
$r_{x_1,\xi} =$	correlation coefficient between x_1 and ξ
$r_{x_2,\xi} =$	correlation coefficient between x_2 and ξ

If this partial correlation coefficient is zero, that is requirement $r_{x_1,x_2} = r_{x_1,\xi}\cdot r_{x_2,\xi}$ is met, it tells that variable ξ is indeed responsible for the measured correlation between x_1 and x_2. These four different ways of interpreting a statistical correlation are mentioned since all of them are applied in structural equation models. It follows from these considerations that explicit assumptions as to the relationships between the variables by a set of hypotheses must be made ex ante by the researcher, which, consequently, also applies to the conception fo the entire structural equation model.

3. Assessing Latent Variables

It has been hinted to the particular characteristic of structural equation models that they can estimate the relations between not directly observable hypothetical constructs by operationalising them via empirically observable indicators. This automatically implies that each construct included is described by at least one indicator variable. In order to avoid any confusion all indicator variables representing exogenous latent variables are here denominated by x, while all indicators referring to endogenous latent variables are represented by y. For differentiating indicators from latent variables the latter are denominated by η (read: Eta) for exogenous latent variables and by ξ (read: Ksi) for endogenous latent variables. A complete structural equation model further includes residual variables that, analogous to the residual score in regression analysis, ought to account for such causes or factors having an influence that are not considered in the model. All the variables of a complete structural equation model are summarised in Figure 54.

Abbreviation	Pronunciation	Meaning
η	Eta	Latent endogenous variable explained in the model
ξ	Ksi	Latent exogenous variable not explained in the model
y	-	Indicator variable for latent endogenous variable
x	-	Indicator variable for latent exogenous variable
ε	Epsilon	Residual variable for indicator variable y
δ	Delta	Residual variable for indicator variable x
ζ	Zeta	Residual variable for latent endogenous variable

Figure 54 Variables in a Complete Structural Equation Model.

The structural model of Figure 53 with latent variables would consequently look as shown in Figure 55.

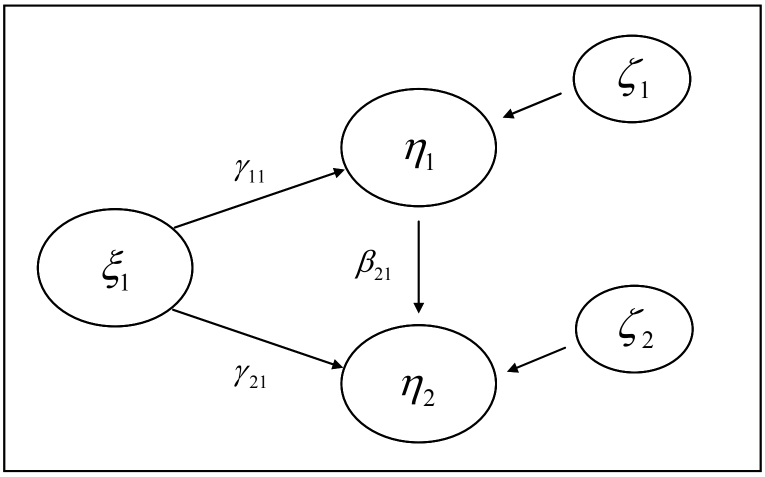

Figure 55 Structural Model with Latent Variables.

The structural equations for the two latent endogenous variables in the path diagram look as follows:

$$(1) \quad \eta_1 = \gamma_{11} \cdot \xi_1 + \zeta_1$$
$$(2) \quad \eta_2 = \beta_{21} \cdot \eta_1 + \gamma_{21} \cdot \xi_1 + \zeta_2$$

It is assumed that the latent variables are standardised and, consequently, coefficients between variables can be regarded as standardised path coefficients; those between latent endogenous variables are represented by β (read: Beta) and those between latent exogenous and endogenous variables by γ (read: Gamma). Instead of writing two equations, the structural model of latent variables can be expressed in a matrix:

$$\begin{pmatrix} \eta_1 \\ \eta_2 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ \beta_{21} & 0 \end{pmatrix} \cdot \begin{pmatrix} \eta_1 \\ \eta_2 \end{pmatrix} + \begin{pmatrix} \gamma_{11} \\ \gamma_{21} \end{pmatrix} \cdot \xi_1 + \begin{pmatrix} \zeta_1 \\ \zeta_2 \end{pmatrix}$$

or in general terms:

$$\eta = B \cdot \eta + \Gamma \cdot \xi + \zeta$$

The crucial point in this regard is that the matrixes of coefficients B and Γ cannot be calculated, simply because no empirical data is available for the correlations between latent variables, which are, by definition, hypothetical and therefore unobservable constructs. Accordingly, it is assumed that all latent variables can be described by indicator variables in a measurement model. Considering the example given, a measurement model of the latent exogenous variable ξ_1 defined by two empirically observable indicator variables would look as depicted in Figure 56.

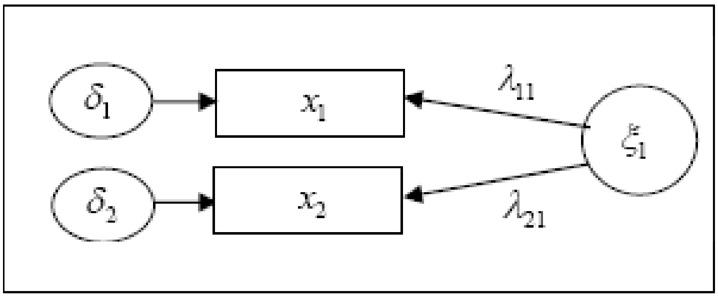

Figure 56 Measurement Model of Exogenous Latent Variables.

If such variables are standardised the measurement model for the example given can be expressed in form of the regression equations of each indicator variable:

$$(1) \quad x_1 = \lambda_{11} \cdot \xi_1 + \delta_1$$
$$(2) \quad x_2 = \lambda_{21} \cdot \xi_1 + \delta_2$$

$$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} \lambda_{11} \\ \lambda_{21} \end{pmatrix} \cdot \xi_1 + \begin{pmatrix} \delta_1 \\ \delta_2 \end{pmatrix}$$

or in general terms:

$$X = \Lambda_x \cdot \xi + \delta$$

Here, Λ_x represents the matrix of path coefficients, ξ the vector of the exogenous variable and δ the residual scores. As already indicated, measurement models are based of the idea of factor analysis and could be interpreted as factor analytic models. Both approaches share the idea that correlations between observable variables are caused by a latent variable, i.e. correlations between them cannot be interpreted empirically directly but only via an explaining force (Homburg and Giering 1996). However, in order to assess the relative influence each indicator variable has on the hypothetical construct it can be resorted to the fundamental theorem of factor analysis, which states that the matrix of correlations R_x describing correlations between indicator variables (x), can be reproduced by:

$$R_x = \Lambda_x \cdot \Phi \cdot \Lambda_x{}' + \Theta_\delta$$

Here, $\Lambda_x{}'$ is the transposed of the Λ_x-matrix and matrix Θ contains the correlations between the factors respectively the endogenous latent variables. Since exogenous latent variables are here assumed not to correlate the fundamental theorem of factor analysis is reduced to:

$$R_x = \Lambda_x \cdot \Lambda_x{}' + \Theta_\delta$$

Here, matrix Λ_x contains the factor loadings of all indicator variables on the latent exogenous variables, while Θ_δ stands for the covariance matrix between the residual scores δ. Factor loadings are, in case of standardised variables, nothing else than the regressions of the indicators on the latent variable, for which regression coefficients and path coefficients are identical. Furthermore - exogenous variables are assumed to be independent - factor loadings correspond to the correlations between indicator variables and hypothetical constructs. Similar to these considerations on the operationalisation of exogenous variables, the measurement model of latent endogenous variables is portrayed in Figure 57.

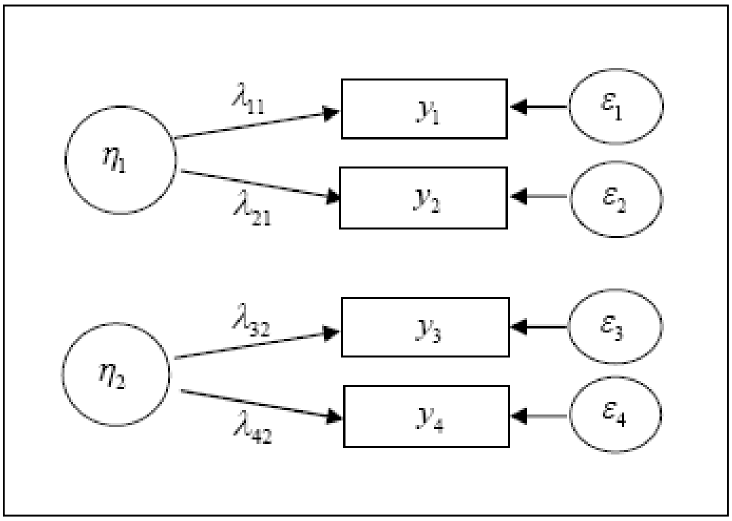

Figure 57 Measurement Model of Endogenous Latent Variables.

Mathematically this measurement model can be expressed by this matrix equation:

$$\begin{pmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \end{pmatrix} = \begin{pmatrix} \lambda_{11} & 0 \\ \lambda_{21} & 0 \\ 0 & \lambda_{32} \\ 0 & \lambda_{42} \end{pmatrix} \cdot \begin{pmatrix} \eta_1 \\ \eta_2 \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{pmatrix}$$

or in general terms:

$$Y = \Lambda_y \cdot \eta + \varepsilon \, .$$

Again, Λ_y contains the factor loadings of the indicator variables y on the latent variables η_1 and η_2, while ε is the vector of the residual scores. Accordingly, the measurement model of latent endogenous variables and the correlations between the empirical indicator variables can be reproduced by regarding it as a factor model:

$$R_y = \Lambda_y \cdot \Lambda_y' + \Theta_\varepsilon$$

The measurement model of endogenous latent variables is different to that of exogenous latent variables in that it permits direct causal dependences between the endogenous variables; for instance, in the example given endogenous factor η_1 has a direct effect on endogenous factor η_2. Bringing together what has been said so far, a complete causal model can be calculated. As shown in Figure 59 it consists of the two measurement models and the structural model.

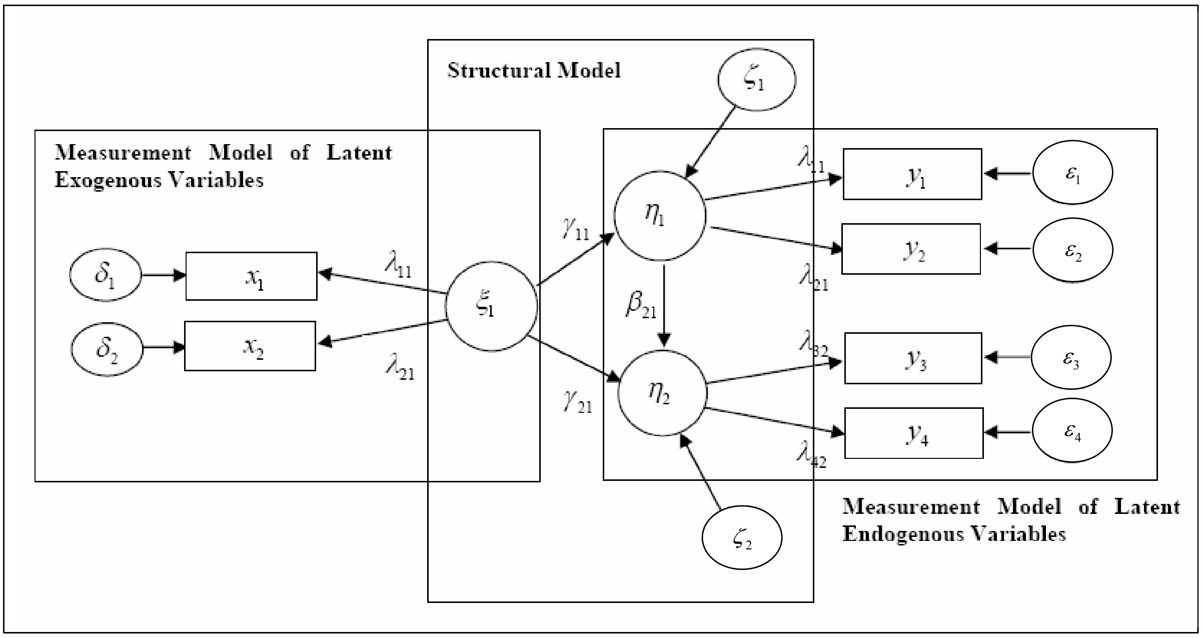

Figure 58 Path Diagram of a Complete Structural Equation Model.

In summary, notations for all necessary parameter matrices of a complete causal model are depicted in Figure 59. However, in order to be mathematically specified it must be identified for all eight matrices, which elements must be estimated. The first four matrices, containing the postulated causal relations, have already been introduced above. While matrix Φ contains covariances and, if the latent variables are standardised, correlations between latent exogenous variables, matrix Ψ covariances or correlations of the residual scores in the structural equations, which reflect the unexplained variance in the latent endogenous constructs. Finally, Θ_ε and Θ_δ contain the matrices of covariances between the measurement errors (Backhaus et al. 2004).

Abbreviation	Pronunciation	Meaning
Λ_y	Lambda - y	Matrix representing the coefficients of paths between y and η-variables.
Λ_x	Lambda - x	Matrix representing the coefficients of paths between x and η -variables.
B	Beta	Matrix representing the postulated causal relations between η -variables.
Γ	Gamma	Matrix representing the postulated relations between ξ and η -variables.
Φ	Phi	Matrix containing the covariances between ξ - variables.
Ψ	Psi	Matrix containing the covariances between ζ - variables.
Θ_ε	Theta-Epsilon	Matrix containing the covariances between ε - variables.
Θ_δ	Theta-Delta	Matrix containing the covariances between δ - variables.

Figure 59 A Complete Structural Equation Model's Matrices.

Based on these parameters, the matrix of covariances for the observed variables x and y can be reproduced by exactly these eight matrices:

$$\sum = \sum\left(\underline{\Lambda}_y, \underline{\Lambda}_x, \underline{B}, \underline{\Gamma}, \underline{\Phi}, \underline{\Psi}, \underline{\Theta}_\varepsilon, \underline{\Theta}_\delta\right) = \sum\left(\underline{\pi}\right)$$

In this equation $\underline{\pi} = \left(\pi_1, \ldots, \pi_t\right)$ represents the vector of the model parameters to be estimated in the eight parameter matrices. This equation is called the model's structure of covariances (see for a complete mathematical derivation Homburg 1989). Accordingly, the problem to solve is estimating the theoretical covariance matrix $\sum\left(\underline{\pi}\right)$ between the latent variables that has the highest probability of creating the empirically observed covariance matrix $\underline{S}$ of the measurement model drawn from the data set. In mathematical terms it is the minimisation of the difference between those two matrices in an iterative estimation procedure. Self-evidently, there exist several estimation algorithms to calculate this difference, varying in the discrepancy function to be minimised.

Available or often used algorithms are not discussed here in detail, rather simply explained which one has been chosen and why (see for an overview e.g. Hildebrandt and Görz 1999). Backhaus et al. (2004) recommend to consider four criteria in selecting an estimation algorithm: To begin with, it should be checked if a (1) multinormal distribution of the manifest variables is given; if (2) the discrepancy function is scale invariant, that is an alteration of the indicators' scaling does not influence the function's minimum; if (3) the sample size is sufficient for the algorithm to be applied, and, finally, (4) if inference statistics are available that allow testing the null hypothesis that the empirical covariance matrix is equal to the theoretical one.

The validity of the entire model can be assessed with a likelihood-ratio-test; by calculating a chi-square value the null hypothesis can be tested, whether the empirical corresponds to the theoretical covariance matrix. If rejected, the alternative hypothesis is that the empirical matrix corresponds to any positive matrix *A*. The resulting likelihood-ratio statistic χ^2 compares the frequency of an observed score of a variable in the sample with the theoretically expected frequency in case the scores of the variable are randomly distributed (Backhaus et al. 2004). Mathematically, this can be determined with:

$$\chi^2 = (n-1) \cdot F\left[\underline{S}, \Sigma(\underline{\pi})\right]$$

with: F = Minimum score of discrepancy function
$\underline{S}$ = Observed covariance matrix
$\Sigma(\underline{\pi})$ = Estimated covariance matrix

In the present context a causal model is usually accepted if the chi-square-score is smaller or equal to the degrees of freedom; this means if χ^2 is divided by the degrees of freedom, the resulting test statistic should equal to one or even be smaller. In practical applications, a model fit is considered good if the ratio is 2.5 or smaller (Homburg and Baumgartner 1995). Further to this, the probability *(p)* can be calculated with which the rejection of the null hypothesis would be an error; it should be noted that the probability of error in classical test theory here corresponds to *(1-p)*. Since the scholar does not want to reject the null hypothesis and, thereby, the model at hand, a high score of *(p)* is positive expressing that the theoretical model can be accepted as good approximation to observed empirical data. As will be clear soon, the interpretation of χ^2 for evaluating the model fit is somehow critical for the present model, particularly because its application requires normal distribution of the manifest variables and a sufficiently large sample; issues which both must be taken with caution in the present case. Therefore, other fit indices based on the likelihood-ratio-χ^2 could be considered in evaluating the model fit that provide further information. For instance, the Akaike-Information-Criterium (AIC), a relative indicator, only suggests selecting the model from the set of possible ones that exhibits the lowest score:

$$AIC = \chi_D^2 + d_D$$

with: d_D = Number of parameters to be estimated

Another criterion is the so called single-sample-cross-validation index (ECVI), which uses the likelihood-ratio-χ^2 to measure the degree of agreement between the theoretical covariance-matrix estimated on basis of the empirical data and that of the matrix which is reproduced from the validation sample with identical sample size (Brown and Cudeck 1993). Jöreskog and Sörbom have implemented a variant which is simply a transformation of the likelihood-ratio-χ^2 (Jöreskog and Sörbom 1993):

$$ECVI = \frac{\chi^2}{n} + 2 \cdot \left[\frac{d_D}{n}\right]$$

Compared to these global criteria, all criteria of partial model fit are based on a somehow different idea, although also using the likelihood-ratio-χ^2: They compare the model fit under to be assessed (the default model) with a chosen reference model, which is more restrictively specified, disposing of less estimators. The model of reference is usually the null-model or independence model; for this it is assumed that all manifest variables are uncorrelated and, therefore, only the variances of manifest variables are calculated (Bentler and Bonnet 1980). For instance, the normed fit index (NFI) compares the minimum of the default model's discrepancy function with the independence model. In contrast, a so called saturated model, for which all possible parameter are estimated, demonstrates a perfect fit of one (Bentler and Bonnet 1980). The NFI can be calculated as follows:

$$NFI = 1 - \left[\frac{\hat{F}_D}{\hat{F}_I}\right] = 1 - \left[\frac{\chi_D^2}{\chi_I^2}\right]$$

with:
$\hat{F}_D =$ Minimum score of default model's discrepancy function
$\hat{F}_I =$ Minimum score of independent model's discrepancy function
$\chi_D^2 =$ Likelihood-ratio- χ^2 for default model
$\chi_I^2 =$ Likelihood-ratio- χ^2 for independent model

The default model's quality can vary between the worst fit (the independent model), which exhibits the score zero, and the perfect fit of the saturated model and the score one. The NFI, hence, indicates whether the model at hand rather equals to one or the other model. Practically, a good model fit can be assumed if NFI exceeds the score of 0.9 (Bentler and Bonnet 1980).

However, subsequent studies were able to show that the NFI is directly dependent of the sample size, reason why it was intended to be improved by the Relative-Fit-Index (RFI) accounting for model complexity via degrees of freedom that, unfortunately, brought up similar problems (Marsh et al. 1996):

$$RFI = \left[\frac{\frac{\chi_D^2}{d_D}}{\frac{\chi_I^2}{d_I}} \right]$$

Similarly, Bollen's Incremental-Fit-Index (IFI) explicitly considers sample size and model complexity but also co-varies with the former (Marsh et al. 1996):

$$IFI = \frac{\chi_I^2 - \chi_D^2}{\chi_I^2 - d_D}$$

Therefore, it is often suggested to consider, additionally, for the Tucker-Lewis-Index (TLI) that offers several advantages beyond its independence of the sample size (Bentler and Bonnet 1980) and was found to be one of the best partial indices (Marsh et al. 1996).[xxxii] The TLI is calculated by the following formula:

$$TLI = \frac{\frac{\chi_I^2}{d_I} - \frac{\chi_D^2}{d_D}}{\frac{\chi_I^2}{d_I} - 1}$$

with: d_I = Independent model's degrees of freedom

d_D = Default model's degrees of freedom

Another index found to deliver good estimates in terms of being not systematically related to sample size and appropriately reflecting systematic variation in model misspecification, is the Bentler (1990)'s Comparative-Fit-Index (CFI) that is equal to the Relative-Noncentrality-Index (RNI). The CFI measures the relation between the non-centrality parameters of the population (NCP) for the default and independent model:

$$CFI = 1 - \frac{NCP_D}{NCP_I}$$

with NCP (Non-Centrality Parameter) = $\frac{\chi^2 - d}{n}$.

Again it is suggested that a CFI exceeding 0.9 indicates a good model fit. However, all the indices based on the likelihood-ratio-χ^2 that have been presented so far assumed that the specified model applies to the whole population; models that only approximately apply to the entire population are consequently falsified for large samples. However, there exist criteria that are dedicated to this population error of approximation and the reliability of the adjustment criteria. Browne and Cudeck (1993) have developed an estimate called Population Discrepancy Function (PDF) for a population assumed only to have on group:

$$\hat{F}_0 = Max\left[\frac{\chi_D^2 - d_D}{n-1}, 0\right] = \frac{NCP}{n-1}$$

Since, the PDF decreases if additional parameters are estimated in the structural equation model, but at the same time model complexity increases, the Root Square Error of Approximation (RMSEA), originally developed by Steiger (1990), is a similar but more valuable indicator, providing information about the average discrepancy per degree of freedom and, therefore, the approximation of the model to reality, i.e. empirical data. For practical applications it is recommended to interpret the RMSEA as indicator for model fit as follows (Backhaus et al. 2004; Browne and Cudeck 1993):

$$RMSEA = \sqrt{\frac{\hat{F}_0}{d_D}}$$

RMSEA ≤ 0.05	Close model fit
RMSEA ≤ 0.08	Reasonable model fit
RMSEA ≥ 0.10	Unacceptable model fit

In addition, by providing PCLOSE, AMOS gives information about the probability of error for the null hypothesis that RMSEA is lower than 0.05 for the default model. Is this score smaller than a given level (usually $\alpha = 0.05$) a good model fit can be assumed (Backhaus et al. 2004).

C. Causal Model of Opportunity Recognition

A causal model is usually built and interpreted in two major steps: to begin with, the constructs or factors are tested for their validity and reliability. Then, after the theoretical data fits the empirical, the model as whole and causal relationships are assessed (e.g. Garson 2007).

1. Assessing Construct Validity and Reliability

The general problem in operationalising theoretical constructs is that they, by definition, cannot be observed directly. Therefore, they are measured, respectively operationalised, by several indicators and, thus, quality of construct measurement must be judged in order to see, whether indicators can be accepted as approximations (Homburg and Hildebrandt 1998). Even though actually directed to scholars in the field of consumer behaviour research, the statement that "[…] most of our measures are only measures because someone says they are, not because they have been shown to satisfy standard measurement criteria […]" (Jacoby 1979, p. 91) can equally be applied to entrepreneurship research, where it has been said that efforts intending to explain entrepreneurial behaviour need to improve validity of constructs (see e.g. Mitchell et al. 2005). At least, it seems to be a scholar's duty to increase transparency concerning this issue in his research. Main criteria usually drawn on in assessing construct quality are reliability and validity. Hereafter, reliability is understood as "[…] the degrees to which measures are free from random error and thus reliability coefficients estimate the amount of systematic variance in a measure." (Peter and Churchill 1986, p. 4) Hence, measurements of indicators are reliable for a factor or construct if a high portion of variance can be explained by their association; at the same time, the influence of measurement error is low (Homburg and Giering 1996).

Validity is an indicator of conceptual appropriateness of the measurement instrument and states whether it really measures what it is supposed to; it is high, "[…] when the differences in observed scores reflect true differences on the characteristic one is attempting to measure and nothing else […]." (Churchill 1979, p. 65) The relation between a measurement's reliability and validity can be illuminated by the following equation:

$$X_O = X_T + X_S + X_R$$

It states that the observed score of a measurement X_0 equals to a variable's true score X_T plus its systematic X_S and random error X_R. The former term refers to a systematic error occurring independent of any random influences with the same value for any measurement; the latter term contains all factors that non-systematically or randomly influence a measurement. Thus, a measurement is reliable if it leads to consistent results or scores, i.e. $X_R = 0$, while it can only be considered valid if the systematic error can be excluded as well, so that $X_0 = X_T$ (Homburg and Giering 1996).

However, there exist more fine-grained concepts of validity focussing on different aspects of conceptual appropriateness; in fact four types of validity must be given in order to assume a valid construct measurement: content, nomological, convergent, and discriminant validity (Hildebrand 1984). While content validity describes the extent to which an indicator represents all facets of a given construct or factor (Bohrnstedt 1970), nomological validity is the extent to which predictions or statements are confirmed in dealing with a larger theory (Peter and Churchill 1986). Convergent validity is the extent to which two or more attempts of measuring the same concept are in agreement, meaning that all indicators describing one construct or factor must exhibit a sufficiently strong relationship. In turn, discriminant validity refers to the extent to which indicators of distinct constructs or factors differ (Bagozzi and Phillips 1982; Homburg and Giering 1996); i.e. indicators for one construct ought to be as homogenous (convergent) as possible, while those describing different ones as heterogeneous (discriminant) as possible.

In the present work the review of relevant literature has led to three, respectively four constructs, which have been measured by at least two indicators and are discussed in the following paragraphs: regulatory focus (promotion- and prevention style), category combination and reorganisation, and opportunity recognition. It should be noted that in the present study the terms of construct and factor can be used synonymously since each construct is only described by one factor. All of them are measured by reflective indicators, i.e. the construct or factor causes the indicator variable's scores and the latter can be regarded as a construct's measures (Homburg and Giering 1996). Homburg and Giering (1996) have suggested a general proceeding for quantitatively analysing hypothetical constructs, which is adjusted to the needs of the present work, respectively the type of constructs used. They propose that a construct's quantitative analysis is carried out in four stages and already preceded by an extensive conceptualisation of the construct by qualitative techniques in order to gain a fundamental understanding and an initial set of measuring indicators. Those are then tested in several pre-tests for finding clear and unambiguous formulated items, as well as testing the indicator's textual relevance for the construct to be measured.

The extensive literature review as well as the efforts to produce test items, outlined in chapter V.A.3, could well be seen as such conceptual preparation. However, many aspects described in their general model are only relevant to multidimensional constructs, which are not included in the present work, since only one-dimensional constructs with one factor are included. Hence, the factors or constructs are separately tested for validity according to the second step of the general process outlined, starting with calculating Cronbach's alpha and item-to-total correlations followed by an exploratory and a confirmatory factor analysis. For each factor or construct the following steps are taken:

Firstly, Cronbach's alpha, a reliability coefficient of the first generation, measuring the reliability of a group of indicators describing one factor or construct is calculated (Cronbach 1951). It can be obtained by applying the formula:

$$\alpha = \frac{k}{k-1} \cdot \left(1 - \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma_k^2} \right).$$

with: $k =$ Number of factor's indicators

$\sigma_i^2 =$ Indicator i's variance

$\sigma_k^2 =$ Variance of all k - indicator's sum

This coefficient can be interpreted as a measure of a factor's indicators internal consistency; it is obtained by dividing the factor's indicators into two equal sets in any possible constellation and correlating the sum of each half. The mean value of all possible combinations of split ups is Cronbach's alpha. As any correlation coefficient it can assume values between zero and one, whereas usually it is followed Nunnally (1978) and suggested that a reliable factor exceeds a minimum value of 0.7 (see e.g. Backhaus et al. 2004; Homburg and Giering 1996). In case a construct does not reach this value, item-to-total correlations are calculated for each indicator; these measures also refer to one factor's indicators but express an indicator's correlation with the sum of all other indicators for this construct. They can be used as iterative criteria for selecting appropriate indicators since manifest variables showing relatively high correlations with total scores have more variance relating to the factor and add more reliability (Nunnally 1978).

Based on this information, indicators with the lowest item-to-total correlation are removed until Cronbach's alpha exceeds the suggested value of 0.7 (Homburg and Giering 1996). When the factor under investigation complies with this requirement, exploratory factor analysis is applied to control whether factor extraction really only detects a single factor and, thus, a reasonable degree of convergent validity can be assumed. Since the objective of detecting such factors in structural equation modelling is finding the causing construct for the measured variables, principal axis factoring or common factor analysis seems to be the appropriate method to be used (Garson 2007; see for details Backhaus et al. 2004). The remaining indicators for each factor are then finally assessed by a confirmatory factor analysis of the factor's model (Homburg and Giering 1996).

For evaluating reliability of estimates in a causal model several criteria exist: Generally, in structural equation models it is often drawn on squared multiple correlation coefficients, which are automatically calculated by AMOS for all indicators as well as latent endogenous variables. These coefficients can assume scores between zero and one; the higher this score the more reliable is the measurement in the model. In general terms, reliability of a variable reflects the degree to which a measurement is subject to a random error, i.e. the degree to which this measurement tallies other independent, comparable measurements of the same variable. Regarding an observed variable the coefficients given in AMOS state, to which extent this measurement contributes to the measurement of the corresponding latent construct. The multiple correlation coefficients for latent endogenous variables can be interpreted as measure of strength of the causal relationship (Backhaus et al. 2004). In case the latent variables are standardised, as in the present model, the indicator reliability is equal to its squared factor loading. The minimum reliability an indicator usually should exceed is given with 0.4 or 0.5; i.e. it is claimed that a construct or factor can explain at least 40 or 50% of an indicator's variance (Homburg and Baumgartner 1995; Homburg and Giering 1996). In case several criteria are not met, further indicators with relatively low reliability must be removed.

The whole process outlined above results in set of indicators for each factor or construct that has been adjusted considering for reliability and convergent validity. The outlined method of assessing a model's construct is now applied to those treated in the present study, namely (a) the ability of opportunity recognition, (b) promotion style and (c) prevention style of regulatory focus, and the (d) the ability of category combination and reorganisation.

An important argument in research on (a) opportunity recognition that has also been discussed in the present work is that the term of entrepreneurial opportunity describes a quite heterogeneous group of different situations (see chapter II.C.1). Accordingly, an individual's ability to recognise a specific type of opportunities might not be helpful in other types of situations; in order to account for this plausible argument, subjects in the survey were confronted with two quite different situations for which it was assumed that different aspects might be responsible for explaining the ability of recognising opportunities. If this is the case, two constructs ought to be included in the model of opportunity recognition, explaining two different types of opportunity recognition.

Interestingly, as shown in Table 6, the reliability of the construct opportunity recognition measured by Cronbach's alpha is higher than 0.7 if the quality and originality of answers given for problem situation one and two (OR1_Quality; OR1_Originality; OR2_Quality; OR2_Originality) are included as manifest variables. Such a factor can explain 60.02% of these indicators' variance. Meeting both initial criteria set for construct reliability, this indicates that the ability of recognising opportunities is given to some individuals in the population independent of the situation they are situated in.

Cronbach's Alpha	**Variance of Indicators Explained**	**Items**
0.771	60.02%	OR1_Quality; OR1_Originality; OR2_Quality; OR2_Originality

Table 6 Reliability Indicators for Opportunity RecognitionConstructs.

However, the method outlined suggests that in a second step it is tested whether exploratory factory analysis executed with SPSS really suggests only one factor for the variables at hand. Indeed, a common factor analysis with a varimax-rotation and Kaiser-normalisation (see Backhaus et al. 2004) for the four indicators suggests to work with two different factors, both exhibiting Eigenvalues larger than one; as Table 7 shows the first would include the variables describing the ability of recognising opportunities in situation one (OR1_Quality; OR1_Originality) and the second those for situation two (OR2_Quality; OR2_Originality).

	Factor 1	2
OR2_Quality	0.190	0.839
OR2_Originality	0.180	0.836
OR1_Quality	0.866	0.196
OR1_Originality	0.863	0.187

Table 7 Rotated Factor Matrix for Opportunity Recognition Constructs.

Considering this result of principal axis factoring, these two constructs for the ability of opportunity recognition in different situations *k* logically deliver reliability indicators even higher than the general construct of opportunity recognition, as is shown in Table 8. Consequently, in the present study two different models might be dealt with: The first one only including a general construct of opportunity recognition, while the second explicitly distinguishing between the two types of problems in situation one ($OR_{k=1}$) and situation two ($OR_{k=2}$). Following the suggestion given by factor analysis, the latter option is chosen.

Option	Construct	Cronbach's alpha	Variance of Indicators Explained	Items
1 (One Construct)	General Opportunity Recognition	0.771	60.02%	OR1_Quality; OR1_Originality; OR2_Quality; OR2_Originality
2 (Two Constructs)	Opportunity Recognition in Situation 1 ($OR_{k=1}$)	0.868	89.19%	OR1_Quality; OR1_Originality
	Opportunity Recognition in Situation 2 ($OR_{k=2}$)	0.848	86.82%	OR2_Quality; OR2_Originality

Table 8 Reliability Indicators for Independent Opportunity Recognition Constructs.

Starting the assessment of (b) promotion style, Cronbach's alpha is calculated for preferences for objectives or goals (TI^G) in problem construction (PC), information encoding (IE), and category selection (CS). This measure assumes a negative value as indicated on the left-hand side columns of Table 9, meaning that the mean covariance between the variables is negative.

Cronbach's alpha	Cronbach's alpha for standardised items	Items
-0.191[xxxiii]	0.353	PC_Objectives; IE_Objectives; CS_Objectives

Table 9 Cronbach's Alpha for Initial Promotion Style Construct.

A closer look at item-to-total correlations in Table 10 shows that it is the preference for objectives in category selection (CS_Objectives) that is negatively correlated with the other two variables.

Indicator	Scale mean value if item removed	Scale variance value if item removed	Adjusted item-scale correlation	Squared multiple correlation	Cronbach's alpha if item removed
PC_Objectives	5.497	2.293	-0.106	0.574	-0.031
IE_Objectives	6.887	3.470	0.409	0.575	-0.330
CS_Objectives	1.758	1.876	-0.146	0.025	0.160

Table 10 Item-to-total Correlations for Initial Problem Style Construct.

Removing this indicator leads to a standardised Cronbach's alpha (which is relevant here due to different scaling of the indicators) of 0.645, meeting the theoretical criteria usually stated for reliable constructs. Therefore, a construct comprising the preference for objectives in constructing problems and encoding information called promotion style is included in the present model of opportunity recognition, for which exploratory factor analysis shows that it accounts for 87.86% of its indicator's variance (see Table 11).

Cronbach's alpha	Cronbach's alpha for standardised items	Variance of Indicators Explained	Items
0.160	0.862	87.86%	PC_Objectives; IE_Objectives

Table 11 Reliability Indicators for Promotion Style.

Interpreting this, it was argued before that cognitive style might guide information processing throughout the whole process or just in several sub-processes (chapter IV.C.1); however, it seems that in category selection people do not stick to their preference for objectives, i.e. to their promotion style. In general, the correlations between preferences for an information type in category selection with those in information encoding and problem construction are negative. The suspect that styles and preferences might be different for the initial stages of creative thinking often described as divergent thinking in contrast to subsequent stages of convergent thinking seems to apply in terms of different cognitive styles guiding individuals' processing. More generally, it might be argued that the initial, tentative representation must be seen different form subsequent processing, such as the selection of an appropriate category from extant knowledge; however, this is an issue researchers in the field of cognitive psychology must dedicate to themselves.

For (c) prevention style in regulatory focus the indicators initially were the preference for restrictions or constraints TI^C in problem construction (PC_Constraints) and information encoding (IE_Constraints), which were expected exhibiting high reliability. Please note that, while the preference for objectives or goals has been named for problem construction, information encoding, and category selection, the preference for constraints or restrictions - here referred to as prevention style - in selecting categories has not been found to have an impact of the output of creative thinking processes. Therefore it was not included in the present work in order to assess the construct of prevention focus. Indeed, they reach a standardised Cronbach's alpha of 0.77 and the resulting factor is able to explain 81.37% of the two variable's variance, thus, meeting the requirements for reliable constructs (see Table 12).

Cronbach's alpha	Cronbach's alpha for standardised items	Variance of Indicators Explained	Items
0.150	0.771	81.37%	PC_Constraints; IE_Constraints

Table 12 Reliability Indicators for Prevention Style.

Alltogether, the subjects' answers in the survey largely support the theory of regulatory focus: The two concepts of promotion and prevention style are negatively correlated with a correlation coefficient of -0.72, which is a result of two facts already introduced. Firstly, in the survey the preferences for different types of information for a cognitive process (e.g. problem construction) are automatically negatively correlated since subjects could only select a limited set of answer options; i.e. in the rather theoretical case an individual only selected answer options representing a preference for goals this implied that they did not chose any of those standing for a preference for constraints. In addition, it has been shown above by high reliability indicators that individuals showing a preference for one type of information in problem construction also tend to exhibit such for information encoding as well. Consequently, the negative correlation can be explained by methodological restrictions and actual answer behaviour in the survey. This arguments are here seen as sufficient to assume that individuals indeed differ as to their regulatory focus,i.e. their preference for attaining goals or restrictions or constraints, in constructing problems and encoding information.

Similarly, the reliability for the (d) construct of category combination and reorganisation measured by the judges average rating's for quality (CC_Quality) and originality (CC_Originality) of answers given meets, with a Cronbach's alpha of 0.892, the criteria for a reliable factor and is capable of explaining 90.29% of the two indicator's variance (see Table 13). Here, it is not necessary to calculate Cronbach's alpha for standardised items because the variables are equally scaled.

Cronbach's alpha	Variance of Indicators Explained	Items
0.892	90.29%	CC_Quality; CC_Originality

Table 13 Reliability Indicators for Category Combination and Reorganisation.

All further factors included in the model are treated as constructs but only measured by one indicator. This has the advantage that different variances can be restricted for the error terms, which otherwise would be automatically zero, assuming that the variable perfectly measures what it is supposed to.

Construct	Cronbach's Alpha	Variance of Indicators *2	Indicators	Factor Loading
Promotion Style	0.862*1	73.8%	Preference for Objectives in Problem Construction (PC_Objectives)	0.90
			Preference for Objectives in Information Encoding (IE_Objectives)	0.84
Prevention Style	0.771*1	81.37%	Preference for Constraints in Problem Construction (PC_Constraints)	0.91
			Preference for Constraints in Information Encoding (IE_Constraints)	0.90
Category Combination	0.892	90.29%	Quality of Categories Combined (CC_Quality)	0.89
			Originality of Categories Combined (CC_Originality)	0.91
Opportunity Recognition	0.771	60.02%	Quality of Opportunity Recognised in Situation 1 (OR1_Quality)	1.00
			Originality of Opportunity Recognised in Situation 1 (OR1_Originality);	0.78
			Quality of Opportunity Recognised in Situation 2 (OR2_Quality)	0.40
			Originality of Opportunity Recognised in Situation 2 (OR2_Originality)	0.35
Opportunity Recognition in Situation 1	0.868	89.19%	Quality of Opportunity Recognised in Situation 1 (OR1_Quality);	0.98
			Originality of Opportunity Recognised in Situation 1 (OR1_Originality)	0.79
Opportunity Recognition in Situation 2	0.848	86.82%	Quality of Opportunity Recognised in Situation 2 (OR2_Quality)	0.88
			Originality of Opportunity Recognised in Situation 2 (OR2_Originality)	0.81
**1 Standardised Alpha* **2 Common Factor Analysis*				

Table 14 Construct Reliability in Present Model.

Table 14 shows a summary of constructs with more than one indicator used in the present model after testing for construct validity. In addition, Figure 60 lists those constructs that are only operationalised by one indicator.

Theoretical Constructs	Variable Name of Constructs	Indicators
Action focus in problem construction	PCActionStyle	PC_Actions (Preference for Actions in Problem Construction)
Information focus in problem construction	PCInfoStyle	PC_Information (Preference for Factual Information in Problem Construction)
Relevance of information focus in information encoding	IEInfoStyle	IE_Relevant_Information (Preference for Relevant Information in Information Encoding)
Principles focus in information encoding	IEPrincipleStyle	IE_Underlying_Principles (Preference for Underlying Principles in Information Encoding)
Principles focus in category selection	CSPrincipleStyle	CS_Underlying_Principles (Preference for Underlying Principles in Category Selection)
Objectives focus in category selection	CSObjectiveStyle	CS_Underlying_Objectives (Preference for Underlying Objectives in Category Selection)
Social Peering focus in category selection	CSPeeringStyle	CS_Social_Peering (Preference for Evaluation of Others in Category Selection)
Action focus in category selection	CSActionStyle	CS_Actions (Preference for Action Plans in Category Selection)

Figure 60 Constructs with only One Indicator in the Present Model.

As said before, when the constructs used can be regarded as valid and reliable, the general model fit must be assessed before causal relations in the structural model can be interpreted. It has to be assessed whether the theoretical model and its estimates reproduce empirical or observed data to an acceptable degree.

2. Assessment of Model Fit

A variety of criteria exist to evaluate the fit between the theoretical model estimated and the empirical data, which must be selected carefully since their meaningfulness is often bound to requirements; in general terms, it is distinguished between global and partial or relative criteria. Before turning attention to such criteria some mathematical requirements that allow calculating structural equation models have to be met: First of all, the manifest variables were tested for normality because maximum likelihood-estimates require their normal distribution. This was assessed by Kolmogorov-Smirnov- and Shapiro-Wilk-tests, which as goodness-of-fit-test overlay a normal curve on actual data, to assess the fit. Such tests assume a null hypothesis of a normal or Gaussian distribution, which means that the fit of the data at hand with the normal curve, is poor.

As Table 15 shows, for all manifest variables included in the model of opportunity recognition the null hypothesis of normal distribution must be rejected since all show low levels of significance, which means that the null hypothesis is incorrect with a high probability.

	Kolmogorov-Smirnov[(a)]			Shapiro-Wilk		
	Statistics	d.f.	significance	statistics	d.f.	significance
PC_Information	.202	112	.000	.919	112	.000
PC_Objectives	.213	112	.000	.882	112	.000
PC_Actions	.157	112	.000	.900	112	.000
PC_Constraints	.199	112	.000	.914	112	.000
IE_Objectives	.096	112	.012	.976	112	.040
IE_Relevant	.095	112	.014	.984	112	.221
IE_Constraints	.082	112	.063	.981	112	.109
IE_Irrelevant	.118	112	.001	.884	112	.000
IE_Principles	.085	112	.047	.983	112	.174
CS_Principles	.132	112	.000	.962	112	.003
CS_Actions	.139	112	.000	.941	112	.000
CS_Objectives	.167	112	.000	.948	112	.000
CS_Social_Peering	.154	112	.000	.965	112	.005
CC_Quality	.108	112	.003	.904	112	.000
CC_Originality	.094	112	.016	.955	112	.001
OR_Overall_Quality	.088	112	.033	.980	112	.092
OR_Overall_Originality	.092	112	.021	.980	112	.087

A correction of significance according to Lilliefors.

Table 15 Test for Normality for Manifest Variables.

Another important theoretical requirement for applying empirical methods based on covariances and correlations is that linearity prevails between variables; it can be tested by comparing the total variance explained by the independent variable η^2 - not assuming a linear relationship exists between the variables - with the proportion of variance in the dependent variable accounted for by the linear relationship R^2. Hence, Table 16 including all manifest variables assessed can be interpreted as follows: For instance, the independent variable of *PC_Information* is capable of explaining 12.52% of the dependent variable's (*OR1_Quality)* variance, if no linear relationship is assumed; a linear model reproducing the relation between them can only account for 0.15%. Evidently, the linear contribution to the total explanation is only approximately 1% and linearity cannot be assumed. However, the contribution of linear models is not always as low as for *PC_Information*; e.g. its explanatory power for the relationship betwenn *PC_Objectives* and the indicators of opportunity recognition are immensly higher. However, although linearity is not strong between the manifest variables used, covariances and correlations are used nevertheless and build the fundament for the following data analysis.

Dependent / Independent	OR1_Quality			OR1_Originality			OR2_Quality			OR2_Originality		
	R^2	η^2	R^2/η^2	R^2	η^2	R^2/η^2	R^2	η^2	R^2/η^2	R^2	η^2	R^2/η^2
PC_Information	0.0015	0.1252	0.01	0.0005	0.1018	0.00	0.0059	0.0590	0.10	0.0111	0.0924	0.12
PC_Objectives	0.0479	0.0999	0.48	0.0170	0.0521	0.33	0.0408	0.0711	0.57	0.0773	0.0886	0.87
PC_Actions	0.1130	0.0060	0.05	0.0150	0.1250	0.12	0.0330	0.0630	0.52	0.0620	0.0900	0.69
PC_Restrictions	0.0160	0.1470	0.11	0.0030	0.0960	0.03	0.0170	0.0830	0.20	0.0340	0.0940	0.36
IE_Objectives	0.0390	0.5080	0.08	0.0310	0.5230	0.06	0.0790	0.4890	0.16	0.0630	0.5150	0.12
IE_Not_Essential	0.0003	0.4668	0.00	0.0061	0.4117	0.01	0.0271	0.5038	0.05	0.0181	0.4644	0.04
IE_Relevant	0.0036	0.3999	0.01	0.0027	0.3735	0.01	0.0003	0.5205	0.00	0.0067	0.4724	0.01
IE_Restrictions	0.0168	0.3526	0.05	0.0005	0.3200	0.00	0.0325	0.4292	0.08	0.0283	0.3924	0.07
IE_Additional	0.0009	0.4390	0.00	0.0019	0.5055	0.00	0.0166	0.4954	0.03	0.0051	0.4171	0.01
IE_Irrelevant	0.0042	0.4035	0.01	0.0284	0.4000	0.07	0.0072	0.4809	0.02	0.0029	0.4128	0.01
IE_Principles	0.0126	0.4359	0.03	0.0013	0.4202	0.00	0.0034	0.4038	0.01	0.0095	0.4308	0.02
CS_Principles	0.0149	0.0770	0.19	0.0078	0.0544	0.14	0.0032	0.0907	0.03	0.0027	0.0792	0.03
CS_Actions	0.0005	0.0251	0.02	0.0000	0.0420	0.00	0.0037	0.0197	0.19	0.0016	0.0584	0.03
CS_Objectives	0.0007	0.0323	0.02	0.0066	0.0420	0.16	0.0005	0.0278	0.02	0.0000	0.0539	0.00
CS_Social_Peering	0.0002	0.1554	0.00	0.0031	0.1172	0.03	0.0019	0.0609	0.03	0.0041	0.0707	0.06
CC_Quality	0.0224	0.2751	0.08	0.0160	0.2455	0.06	0.0298	0.2370	0.13	0.0053	0.1335	0.04
CC_Originality	0.0229	0.2788	0.08	0.0240	0.2427	0.10	0.0126	0.2320	0.05	0.0005	0.1355	0.00

Table 16 Test for Linearity for Manifest Variables.

Another requirement is the identifiability of the model, which refers to the question whether an equation model can be unequivocally solved; it must be tested if information from the empirical data is sufficient to identify the equations included in the model. A multi-equation model (which all structural equation models are per definition) is solvable if the number of equations at least equals to the number of parameters that must be estimated; put differently, the equation system's degrees of freedom (d.f.) must be at least zero or even positive. This could be seen as a rule of thumb (Backhaus et al. 2004). A model including all cognitive styles discussed before has 89 d.f. and AMOS indicates the model is identified. Since in the present work manifest variables are not normally distributed, as shown above, the discrepancy is scale invariant, the sample size sufficient but not very large, and inference statistics available the unweighted and the scale free least-squares method seem to be most appropriate (see Arbuckle 1997; Backhaus et al. 2004).

In order to find an acceptable causal conceptualisation of opportunity recognition, a first model could be developed that includes all reliable and valid constructs that have been introduced so far. Such an initial structural equation model including all preference types for problem construction, information encoding, as well as category selection and the constructs of category combination and reorganisation as well as opportunity recognition was developed and calculated; it is depicted in Figure 61.

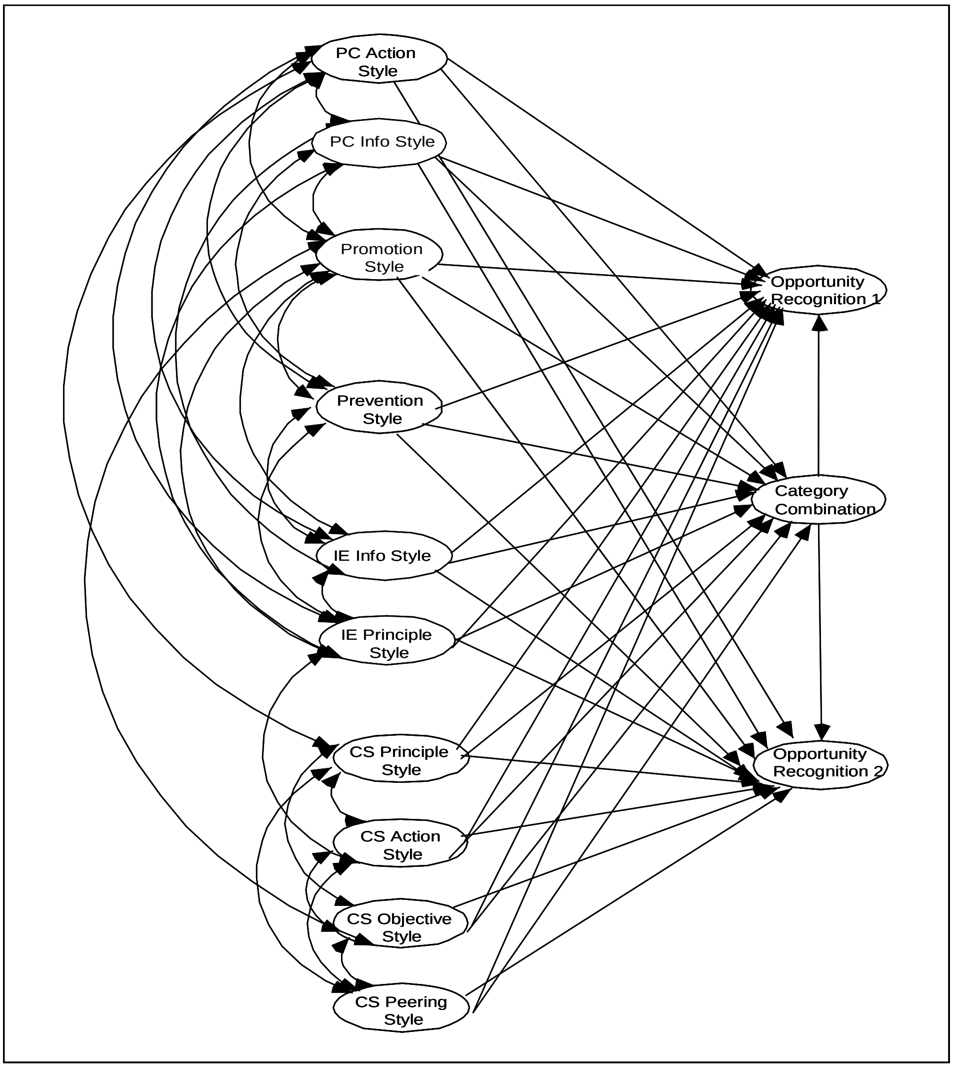

Figure 61 Structural Model of the Initial Model of Opportunity Recognition.[xxxiv]

However, the actual goal was to arrive at a model for which a causal analysis seems potentially sensible, in the sense that the causal relationships within are sufficiently unlikely to be produced by chance (Backhaus et al. 2004). Indeed, a look at empirical correlations between indicator variables already showed that only a few indicators for independent constructs are significantly correlated with those for opportunity recognition. Table 17 shows that only the highlighted indicators for the constructs of promotion and prevention style of regulatory focus, of action style in problem construction, as well as category combination seem to have an statistically mentionable impact on opportunity recognition.

	OR1_Quality	OR1_Originality	OR2_Quality	OR2_Originality	OR Overall[xxxv]	OR 1 Overall	OR 2 Overall
PC_Information	-0.039	0.022	0.077	0.105	0.089	0.037	0.123
PC_Objectives	.219(*)	0.130	.202(*)	.278(**)	0.066	0.013	0.111
PC_Actions	-0.076	-0.124	-0.182	-.248(**)	-0.144	-0.062	-.196(*)
PC_Restrictions	-0.127	-0.054	-0.131	-.183(*)	-0.029	0.006	-0.064
IE_Objectives	.198(*)	0.175	.281(**)	.252(**)	0.151	0.079	.187(*)
IE_Not_Essential	-0.019	-0.078	-0.165	-0.134	-0.095	-0.043	-0.127
IE_Relevant	-0.060	-0.052	-0.018	-0.082	-0.063	-0.061	-0.041
IE_Restrictions	-0.130	-0.023	-0.180	-0.168	-0.064	-0.006	-0.114
IE_Additional	-0.030	-0.044	-0.129	-0.072	0.005	0.023	-0.020
IE_Irrelevant	-0.065	-0.169	-0.085	-0.053	-0.162	-0.145	-0.120
IE_Principles	-0.112	-0.036	-0.058	-0.098	-0.123	-0.089	-0.119
CS_Principles	-0.122	-0.088	0.056	-0.052	-0.095	-0.145	0.009
CS_Actions	-0.022	0.007	0.061	0.040	0.048	0.001	0.091
CS_Objectives	-0.026	-0.081	-0.022	0.005	-0.012	-0.020	0.003
CS_Social_Peering	0.015	0.055	-0.043	-0.064	-0.024	0.051	-0.113
CC_Quality	0.150	0.126	0.173	0.073	.210(*)	0.172	0.176
CC_Originality	0.151	0.155	0.112	0.022	.198(*)	.200(*)	0.116
CC_Overall	0.158	0.148	0.149	0.049	.214(*)	.196(*)	0.153

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 17 Empirical Correlations between Indicator Variables.

Additionally, it has been controlled for the influence of the reference measures that were assessed and no significant role could be found: Firstly, it was checked whether more knowledge in the two domains, in which the opportunity recognition processes of the present study were situated in, had an influence on opportunity recognition: However, they showed no significant influence, measured by analysis of variances and correlations, on the dependent variables. Similarly, individuals who had already started a business and, therefore, could be considered as entrepreneurs did only show a slightly higher ability to recognise entrepreneurial opportunities; however this effect was not significant for the present data, so it could not be considered hereafter. This result supports the assertion repeatedly stated in the present work that venture creation per se is not a good proxy for investigating opportunity recognition. The same was true for the characteristic whether an individual's family member had already started a business. Even the motivation or intention to start a business showed no positive effect on the ability to recognise entrepreneurial opportunities as judged by the experts asked in the present study.

In a next step, these four constructs were included in a structural equation model. It revealed that only the constructs of promotion style and category combination have an significant influence on opportunity recognition. Conseuquently, the null hypotheses no. 2, 4, 5, 6, 7, 8, 9, 10, and 11 were accepted that no empirical correlation exists between all other constructs and the ability to recognise entrepreneurial opportunities. In fact, this does not mean that there necessarily exists no causal relationship; methodological insufficiencies of the present study might have hindered such to be revealed.

Disregarding such possible caveats, the modification process led to a smaller model, which is all the more interesting in the results it reveals. This final model with 16 d.f. only includes the constructs of promotion style of regulatory focus, category combination and reorganisation, and opportunity recognition in the two opportunity recognition-situations. This model showed a similar quality in terms of global criteria of AIC and ECVI, assuming lower values for the final model, which has been named as selection criteria. The model fit of the final model is shown in Table 18.

Fit Criteria	Good Model Fit	Final Model
χ^2	< 2.5	1.890
AIC	-	70.346
ECVI	-	0.617
NFI	> 0.9	0.939
RFI	> 0.9	0.887
IFI	> 0.9	0.970
TLI	> 0.9	0.943
CFI	> 0.9	0.970
RMSEA	< 0.8	0.08 (reasonable fit)

Table 18 Model Fit of Final Model.

3. Analysing and Testing Hypotheses

The second main application of causal analysis, besides assessing constructs, is the confirmatory analysis of hypotheses that can be done after accepting the model's global adjustment by evaluating the structural model. Here, this means that for each parameter in the final model the level of significance is given, also between latent variables, which allows hypothesis testing. It should be noted that causal analysis is superior to any regression analysis because it is possible to (1) determine global adjustment criteria, which provide information about to which extent the specified model structure as a whole is capable of explaining covariances between manifest variables, and (2) secondly, to analyse more complex causal structures (Backhaus et al. 2004).

The latter point is of particular interest since it must be differentiated between empirical correlations and causal effects: While regression analysis only provides correlation coefficients as proxies for causal relations, causal analysis allows dissecting such into different causal effects. Generally, it is possible to differentiate three, respectively four, types of effects between latent variables: direct and indirect effects as well as illusory correlation and non-correlation effects. The former two can certainly be illuminated by the following example taken from Homburg and Hildebrandt (1998): It is intended to obtain information about the total effect variable *A* has on variable *D* by dissecting it into direct and indirect effects.

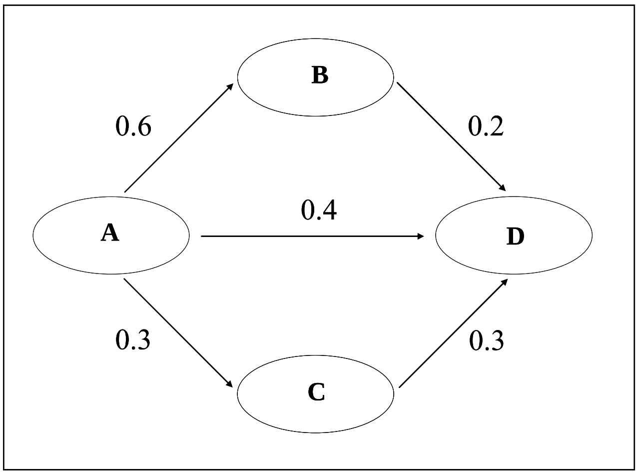

Figure 62 Effects Between Latent Variables (Homburg and Hildebrandt 1998).

In this example shown in Figure 62, the direct effect of *A* on *D* is practically amplified by the indirect effects via variables *B* and *C* (apparently such effects might also be attenuating). In addition to this, it is possible to identify illusory correlations between variables that empirical correlation coefficients cannot reveal. In contrast to direct and indirect effects, this illusory effect does not describe a causal relationship between involved variables. In turn, it might be that only including a third variable reveals the direct causal effect between the two variables of interest. A detailed abstract discussion is left out and instead pointed out, what is meant with the terms in relation to the causal analysis of the model of opportunity recognition under investigation. Figure 63 shows the resulting causal model of opportunity recognition in the present work only including significant relationships, which serves as the footing for a more detailed analysis.

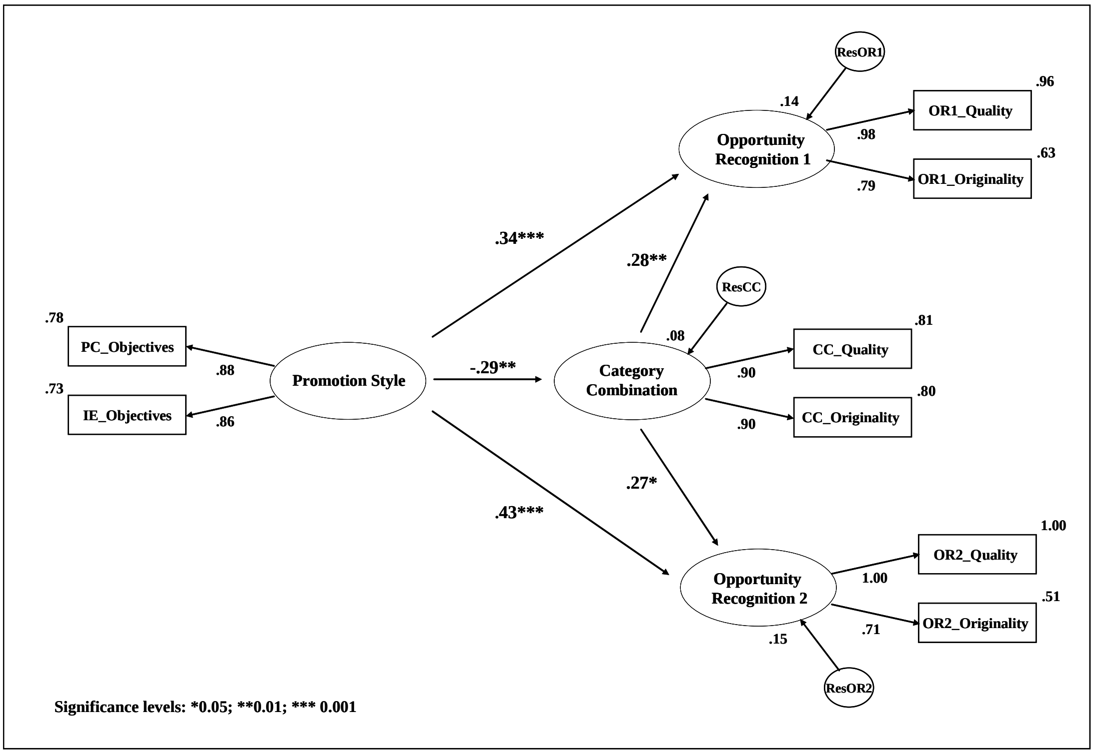

Figure 63 Final Structural Model of Significant Relations.[xxxvi]

AMOS calculated estimated a correlation coefficient between promotion focus and opportunity recognition in situation one of $r_{TI^G,OR^1} = 0.263$ and in situation two of $r_{TI^G,OR^2} = 0.348$. Further, these two measures can be interpreted causally by considering the path coefficients (p) given in the model depicted in Figure 63, which are equal to the standardised partial regression coefficients that have been introduced in chapter V.B.2: The causal model reveals that the direct causal effect measured by the path coefficients is higher than the empirical correlation measured with $p_{TI^G,OR^1} = 0.344$ and $p_{TI^G,OR^2} = 0.426$. Reason is that an indirect causal effect through the intervening construct of category combination and reorganisation attenuates the bivariate correlation between promotion focus and opportunity recognition.

This impact can be quantified by multiplying the negative regression coefficient of promotion style on category combination and reorganisation with the positive one of category combination and reorganisation on opportunity recognition; in situation one this effect amounts to $p_{TI^G CC} \cdot p_{CC,OR^1} = (-0.29) \cdot 0.28 = -0.081$ and in situation two to $p_{TI^G CC} \cdot p_{CC,OR^2} = (-0.29) \cdot 0.27 = -0.078$; these considerations for the causal relationship between a promotion style and the ability to recognise entrepreneurial opportunities are summarised in Table 19. These direct effects permit to state for the promotion style of regulatory focus that regression weights or path coefficients in the prediction of opportunity recognition in situation one $\left(r_{TI^G,OR^1}\right)$ and two $\left(r_{TI^G,OR^2}\right)$ are significantly different from zero at the 0.001 level of significance, practically ruling out that the correlations measured are only caused by chance, if the theoretical model is accepted. Therefore, null hypothesis is rejected for hypotheses no. 3 and concluded that the empirical data indeed supports the conjecture that a promotion style of regulatory focus enhances the ability to recognise entrepreneurial opportunities.

General	$r_{TI^G,OR} = p_{TI^G,OR} + p_{TI^G CC} \cdot p_{CC,OR}$
	Empirical Correlation = Direct Causal Effect + Indirect Causal Effect
OR-Situation 1	$r_{TI^G,OR^1} = 0.263 = 0.344 + \left(-0.29\right) \cdot 0.28$
OR-Situation 2	$r_{TI^G,OR^2} = 0.348 = 0.426 + \left(-0.29\right) \cdot 0.27$

Table 19 Relation between Promotion Style and Opportunity Recognition.

Concerning the relationship between regulatory focus and category combination and reorganisation, it has been said that relevant literature and empirical results on the relationship between an individual's regulatory focus and creativity suggest that a promotion focus significantly produces more novel outcomes than a prevention focus (e.g. Friedman and Förster 2001). However, the present data do not support this argumentation; and even though it is not at the core of the present work, some considerations should be provided to the reader, showing that the negative relationship between a promotion focus and category combination and reorganisation in the present model does not necessarily question its validity. First of all, it must be said that studies supporting the enhancing effect of a promotion focus on creativity experimentally manipulate the situational regulatory focus. Their results indicate that an induced situational promotion focus is positively correlated with creativity. In turn, the present study intended to assess an individual's rather chronic preference style for aspirations or responsibilities, independent of a currently activated focus experimentally manipulated. Therefore, it might be argued that the contradictory findings can be explained by differentiating between chronic and situational regulatory focus. In addition, it might be argued that category combination and reorganisation is just one out of many creative abilities that make up the rather aggregative construct of creativity (see chapter III.C.2).

Even though the model depicted above suggests that the effects of category combination and reorganisation on opportunity recognition are unequally more intuitive and palpable since indirect the former construct only influences the latter directly: However, in fact the direct causal effects of category combination and reorganisation on opportunity recognition are not as high as a first look on the path diagram suggests because they embrace a illusory correlative effect that is caused by the effect promotion style has an opportunity recognition as well. These considerations and the respective numbers are summarised in Table 20.

General	$r_{CC,OR} = p_{CC,OR}$
	Empirical Correlation = Direct Causal Effect + Illusory Correlative Effect
OR-Situation 1	$r_{CC,OR^1} = 0.182 = 0.281 + (-0.29) \cdot 0.34$
OR-Situation 2	$r_{CC,OR^2} = 0.145 = 0.270 + (-0.29) \cdot 0.43$

Table 20 Relation between Category Combination and Opportunity Recognition.

However, the null hypothesis for no. 12 (see Figure 64) is also rejected and on the basis of the present study it can be stated that the ability to combine knowledge categories indeed positively influences the ability to recognise entrepreneurial opportunities.

In summary, there are only two constructs for which the null hypothesis can be rejected and there indeed a relation with the ability to recognise entrepreneurial opportunities can be assumed: the promotion style of regulatory focus and category combination and reorganisation. Both show regression weights in the prediction of opportunity recognition in situation one and two which are significantly different from zero at least at the 0.05 level of significance. It can be inferred on basis of the present data that a promotion focus in problem finding and information encoding as well as a high ability to combine and reorganise knowledge categories contribute to the ability to recognise entrepreneurial opportunities. Summarising the results of the causal analysis, Figure 64 highlights those preferences or styles for which a causal relationship can be assumed based on the present study.

Explaining Construct		Explained Construct	Postulated Effect
GH_1:	**Promotion Style of Regulatory Focus**	**Ability to opportunity recognition**	+
GH_2:	Prevention Style in Regulatory Focus		-
GH_3:	Action Style in Constructing Problems		+
GH_4:	Information Style in Constructing Problems		+
GH_5:	Inconsistent Information Search Style		+
GH_6:	Irrelevant Information Search Style		+
GH_7	Principle Search Style		+
GH_8:	Principle Style in Category Search		+
GH_9:	Goal style in Category Search		+
GH_{10}:	Peering style in Category Search		-
GH_{11}:	Action style in Category Search		-
GH_{12}:	**Ability to category combination and**		+

Figure 64 Causal Relationships Tested For in the Present Study.

Indeed, the studies that found the positive relationship between promotion focus and creativity used other abilities or tasks as approximations for creativity, such as visual insight tasks (e.g. Friedman and Förster 2001).

[xxx] The model developed later on also includes category combination as depdendent variable; however, the investigation of these relations is not the present study's primary obejctive since category combination is only relevant as intervening variable having an effect on opportunity recognition as dependent variable.

[xxxi] Although these results indicate that the measures are not as reliable as others used in the present work, they are used for assessing opportunity recognition hereafter.

[xxxii] The Tucker-Lewis Index (TLI) is sometimes also referred to as Non-Normed-Fit-Index (NNFI) (see e.g. Bentler and Bonett 1980).

[xxxiii] Theoretically, Cronbach's alpha, as a reliability coefficient describing a proportion of variance, can only assume a value between 0 and 1. However in paractical terms, looking at its mathematical definition it will be negative whenever the average covariance among the items is negative, as in the present case of unstandardised items.

[xxxiv] Please note that the present work does not deal with hypotheses regarding the ability of category combination and reorganisation, it is only seen as intervening variable effecting the interesting ability of opportunity recognition.

[xxxv] Please note that these overall measures for opportunity recognition do not equal to the constructs used later on; they are only mean scores and, therefore, rather represent simple total scores for opportunity recognition.

[xxxvi] Please note that two independent models could have been given here since the path coefficients of promotion style as well as category combination and reorganisation on opportunity recognition exhibit different values and, therefore, strengths.

"Weather forecasting, also, would be easier in the absence of an athmosphere." *(Shackle 1972, p. 231)*

VI. Conclusion

To begin with, it must be admitted that besides the methodological caveats already discussed, the theoretical discussion and the results of the empirical study have shown that creative achievement in economic situations, i.e. performance over time across multiple economic situations, will require many skills in applying a variety of heuristics, which are highly interactively applied. This definitely limits the possibilities to generalise any implication drawn from observed behaviour, although the present study intended to account for such an embeddedness-view. These leads to various limitations, such as that the sample was only drawn from one region in Germany. Thus, results are somewhat limited in applicability to other cultures.

Even bearing these caveats and the many not even mentioned here in mind**,** it is argued that the present study has some noteworthy implications for scholars in the field and entrepreneurship education respectively. Hence, the first part of this concluding chapter will interpret the results observed theoretically for the relations between opportunity recognition and regulatory focus as well as category combination and reorganisation respectively, causal relationships for which the present study insinuates the initial suspicion they might be important. Then, for each of these two concepts some major implications for entrepreneurship education and policy-making, aiming at influencing the ability of opportunity recognition are outlined. The second part is dedicated to future research that might tie up to the present study. Finally, the whole work is briefly summarised in the last part C.

A. Interpretation and Implications

The results of the present study suggest, similar to other studies (e.g. Bryant 2007; McMullen and Shepherd 2002), that a situation's framing expressed via a regulatory focus significantly influences entrepreneurial behaviour. Further, the theoretical suggestions that a promotion focus should be advantageous in recognising entrepreneurial opportunities can be supported by the present findings. However, it is theoretically hypothesised by scholars that individuals with such a promotion focus generate more and more unique alternatives in a given situation compared to those in a prevention mode (Brockner et al. 2004). The main argument for a superior ability to recognise entrepreneurial opportunities is thus seen in a higher degree of creativity. The present study, given category combination and reorganisation is accepted as an operationalisation of creativity, does not support these findings since promotion style shows a significant negative correlation with this ability. Therefore, it is argued that the aspect of creativity is not the main reason why people with a promotion focus are better in opportunity recognition. This appears to be an interesting finding, considering that category combination and reorganisation as a creative ability is nevertheless positively correlated with opportunity recognition, opening the room for discussions which aspect of a promotion style offers some explanatory power for the present observations?

Generally, the present study suggests in this concern that individuals intending to attain desired ends are more successful in developing entrepreneurial opportunities than those who aim at moving away from undesired ends, i.e. it can be argued that framing economic situations so that opportunities are tried to be realised, seemingly more open to risk and avoiding to miss such situations, increases the probability of recognising an entrepreneurial opportunity or, more precisely, the quality and originality of novel problem-solutions. Studies were able to show that people with different regulatory styles approach thinking tasks with significantly different strategies. For instance, experiments by Roese, Hur, and Pennington (1999) revealed different strategies of individuals in either a promotion or prevention style in counterfactual thinking, which has been suggested as one critical information process in opportunity recognition (Gaglio and Katz 2001). Very briefly, it was found that individuals in a promotion style apply counterfactual thinking in the absence of a positive outcome, for which they then produced more additive counterfactuals than individuals in a prevention style. In addition, causal inference from counterfactuals and the affective activation of the latter is moderated by regulatory focus (Roese et al. 1999). Such findings, similar to the findings in the present study, suggest that cognitive strategies or heuristics applied by individuals in a promotion focus are more successful in recognising entrepreneurial opportunities, at a first glance, totally irrespective of transformational processes, such as category combination and reorganisation.

Considering the general conclusion that a promotion style is advantageous not only for entrepreneurial behaviour in general, but also for opportunity recognition in particular, together with the insight that an individual's regulatory focus can be primed and enhance through appropriate interventions, measures could be incorporated into the training and education of entrepreneurs for enhancing the ability to recognise entrepreneurial opportunities (Bryant 2007). Such efforts could be linked to those that are already implemented in entrepreneurship education in order to induce a sense of self-efficacy, which has been introduced as a self-regulatory concept as well (Béchard and Grégoire 2005). All such efforts base on the postulate that the discovery of entrepreneurial opportunities can be taught (Fiet et al. 2004b), and particularly that the research shift from personality to cognition allows developing education and training that have a significant impact on entrepreneurial behaviour (Bryant 2006; Young 1997). In this regard, a literature review by Béchard and Grégoire (2005) has revealed that theoretical efforts to enhance entrepreneurship education by psycho-cognitive education theories mainly focus on learning processes, prior knowledge, spontaneous representations, or cognitive conflicts, which are all dimensions that play a role in individual learning embedded in the formal educational context.

Given the premise that a promotion focus or style can positively influence the likelihood of opportunity recognition, a sensible way for entrepreneurship education might be to influence the latter by promoting the former via such inducing individual learning processes. In the present context of self-regulation, it seems that educational measures should aim at strengthening the relationship between an individual's regulatory focus and metacognition. Such knowledge about cognition, which refers to declarative and procedural knowledge, should be able to nurture and strengthen the relationship between the regulatory concepts, between the sense of prior success in achieving positive goals, the sense of efficacy for entrepreneurial tasks, and self-awareness of their cognitive skills (Bryant 2006).

Basically, two different ways could be gone to promote entrepreneurial behaviour via this psychological concept: The first, (1) regulatory pride, is related to regulatory focus as a chronic schema and refers to an individual's personal, subjective history of success in the relevant domain. In turn, the second approach, focusing on (2) factors influencing regulatory focus strengths in a situation, targets on the situational logic behind this concept and the extent to which a particular focus is salient, meaningful, or important.

Theoretically, it seems to be more fruitful to shape individuals' chronic regulatory focus towards a promotion focus in order to enhance the ability to recognise entrepreneurial opportunities in a given population. However, such a way requires a long-term effort to promote this particular preference style since it is, as already argued, already highly shaped by parents in early childhood. It could be hypothesised that this is one of the reasons why an entrepreneurial family is often found to be a good indicator for an individual's propensity to start a business; entrepreneurial parents do have a promotion-focus regulative style and transfer it to their children, which themselves are more entrepreneurial, for instance more likely to identify an opportunity than other economic agents.

Notwithstanding it seems clearly sensible to encourage a promotion-oriented regulative style in a population from the present perspective, although it must be admitted that it seems quite difficult and costly for entrepreneurship education to shape chronic schema. This consideration provides another argument for those scholars claiming for efforts of entrepreneurship education directed at younger children, already starting in childhood. Assuming an evolutionary perspective, a regulatory focus might here be seen as a selection mechanism for the decision to become an entrepreneur, induced by an opportunity and not a necessity. Accordingly, it might be argued that educational efforts directed to individuals exhibiting a chronic promotion focus might be more promising, reason why such individuals should be promoted more intensively than those in prevention focus (Bryant 2006).

However, in case the distribution of regulatory focus in a population is assumed to be exogenously given and, therefore, shaping chronic regulatory focus is not considered as feasible, other measures must be conceived that follow another logic: Then, it is not an individual's regulatory style that is supposed to be influenced but instead the situational framing is changed. This idea is based on studies (Brendl et al. 1995; Crowe and Higgins 1997; Friedman and Förster 2001) showing that the deliberate framing of situational context is capable of activating either a prevention or promotion focus, independent of an individual's chronic regulatory focus (Corbett and Hmieleski 2007). If that is possible, educational measures for enhancing the ability of recognising entrepreneurial opportunities can be conceived that target the framing of particular situations in a promotion style, e.g. in appropriate cases studies or start-up simulations. For instance, a teacher can frame a situation in a gain-nongain concern with the presence and absence of positive outcomes (promotion concerns) or in form of a nonloss-loss concern with the presence and absence of negative outcomes (prevention concerns) (Higgins 2000). This fits to claims that rhetoric in entrepreneurship education should focus on ideals that are put into exciting visions that are desirable (Brockner et al. 2004), more specifically teachers should talk about attaining hits and the means necessary to achieve such.

Further elaborating this argument, psychologist state that the pursuit of goals with a higher regulatory fit provides an individual with a higher personal value than that without; this insight, together with the seemingly superior ability of promotion-focussed individuals to recognise entrepreneurial opportunities, might provide interesting insights for entrepreneurship research that aims at enforcing opportunity recognition.

Research on regulatory fit has shown that a high fit, i.e. that means an individual pursuits to meet goals, which fit its regulatory orientation, thereby increasing the subjectively perceived value of what it is doing. In this case, a decision is often perceived as good independent of the value of worth, i.e. the more objective value of this decision's outcome. Thus, individuals taking decisions with a high regulatory fit are inclined towards goals and means fitting their regulatory orientation, are more strongly motivated, imagine feeling better if they made a desirable decision and feeling worse in the opposite case, feeling more alert when they make a choice, and evaluate it more positively afterwards; similarly, they prospectively and retrospectively enjoy goal pursuit more and assign higher monetary value to an object they have chosen when the choice was made with higher regulatory fit (Higgins 2000).

Apparently, the concept of regulator fit is based on the conviction that a decision's evaluation can be theoretically dissected into worth, e.g. monetary value, and regulatory fit. However, practically this differentiation, for instance by identifying the relative contribution of these two parts, is hard to make in particular by individuals themselves. In fact, the contribution of regulatory fit seems to be more subtle than that of worth, and it might often be the case that the value from fit contribution is subjectively transferred to the value from worth contribution. This fact, which is based on the constructivist view of the present work, opens the road for certain measures influencing an individual's decision making, by manipulating regulatory fit, because a change in the latter is independent of the outcomes of a decision; i.e. a change in regulatory fit can change the perceived worth of the same choice or decisions with the same outcomes (Higgins et al. 2003). What does this possibility to frame situations imply for measures aimed at enhancing entrepreneurship and opportunity recognition?

If it is true that promotion-focused individuals are more entrepreneurial and a have higher ability to recognise entrepreneurial opportunities, this could be used in entrepreneurship education to influence their propensity to start a business or consider this option of action; the framing of such an option or situation could be changed to provide a higher regulatory fit for a promotion style so that such individuals attribute a higher total value to this option, whereas the rather objective value of worth is not changed at all. In some more detail, goals should be framed as positive outcomes, as promotion concerns such as independency, that appeal to promotion-focussed individuals; consequently, ensuring a high regulative fit, necessary actions for starting entrepreneurial activity should be communicated as eagerness means. In summary, entrepreneurial situations could be framed as positive task achievement scenarios, for which individuals are prompted to associate such learning experiences with their accumulated subjective history of positive task achievement, e.g. successful performance in school or sports (Bryant 2006; Lumpkin et al. 2001).

Attached to such individual learning processes, it might turn out sensible to explore how metacognitive thinking can be deliberately practised in an entrepreneurial context leading to the creation of entrepreneurial expertise by facilitating self-reflection, understanding, and finally the control of an individual's entrepreneurial cognitions (Bryant 2006; Mitchell et al. 2007)? Thinkable aspects of such efforts in entrepreneurship education might consist in teaching the ability of metamemory, which is knowing about using memory systems, metacomprehension, the ability of monitoring the sense-making of incoming information and employing certain strategies to such processes, as well as self-regulation, which refers in this particular context to the ability of adjusting individual learning processes depending of feedback experienced (Mitchell et al. 2007).

Another, probably rather complementary, educational strategy might consist in finding educational measures that relate positive task achievement with cognitive self-awareness of intuitively applied strategies and heuristics. Such increased awareness on a meta-level should encourage the conviction that such cognitive strategies are normal and necessary in entrepreneurial behaviour (Bryant 2006); further, given that an individual's regulatory focus can really be identified, it might also have an impact on interaction between players in the entrepreneurial process. For instance, such information could be used by entrepreneurs, investors, or consultants to evaluate individuals in terms of their personal eligibility. This might be an important aspect, considering the general importance that is attributed to the entrepreneur or the team in investment processes (see e.g. Muzyka et al. 1996). Even more generally, information about other individual's regulatory focus could increase mutual understanding and reduce information asymmetries, e.g. between entrepreneurs and venture capitalists that might be oriented towards avoiding misses, i.e. investing in unsuccessful start-ups.

Category combination and reorganisation, by virtue of its role in the creation of new knowledge, has traditionally been seen as a foundation of creative thought. In the present study, it has been shown that conceptual combination also contributes to the recognition of entrepreneurial opportunities. Admittedly, this is not a new nor surprising result, given that transformational process, such as analogical reasoning or bisociation, have been often been named as crucial to opportunity recognition. However, the central value of the findings here is that it is dealt with an underlying process or ability of many transformational processes that are hypothesised to enhance the ability of opportunity recognition. Many implications for teaching and educating entrepreneurship can be inferred from the starting point that it seems sensible to search for appropriate measures to enhance the ability of category combination and reorganisation in order to promote the ability of opportunity recognition. This corresponds to the general postulation already made in entrepreneurship research that teaching creativity skills can enhance opportunity recognition (Lumpkin et al. 2001); however, as said, being aware of a more basic cognitive process facilitating opportunity recognition might lead to an expansion of entrepreneurship education measures by efforts that are directed towards a greater audience since such basic ability to combine categories should be productive in more situations than more specific transformational thinking processes.

A feasible strategy might consist in taking a look at general literature on developing this ability and adapting it to the field of entrepreneurship and opportunity recognition. Such a general instrument might be case-based teaching of combination and reorganisation procedures: Studies were able to show that measures to enhance the ability of category combination and reorganisation - in the sense of producing novel, high-quality problem solutions - highly depends on a situation’s framing. For instance, information on a problem might be made available in form of general principles or underlying mechanisms (analogical approach) or alternatively as a case (case-based approach); in reaction to these two different ways of providing relevant information, different heuristics are applied (Scott et al. 2005). Since entrepreneurial cognition is embedded in specific situations it seems sensible to choose a case-based approached rather than one organised in terms of abstract principles to teach the ability of category combination and reorganisation, and, hence, the ability of opportunity recognition in the context of entrepreneurship. If potential entrepreneurs are trained with such instruments, they may be able to activate such stored cases, on basis of similar goals recognised, and specify necessary actions along with attributes that might have an impact on the success of options of actions available in that situation.

This argument is supported by findings stating that for creating innovative problem solutions supposed to work in complex socio-technical systems a case-based approach seems more promising than an analogical approach as alleged by other scholars in the field of entrepreneurship (Mumford 2002; Scott et al. 2005). Such case-based approaches differ from analogical ones mainly in that they are more bound to specific characteristics of situations and less to underlying principles or mechanisms. Particularly, goal attainment, as well as key contingencies, necessary resources, and constraints from previous situations or cases are evaluated regarding their relevance for the situation at hand and rearranged or restructured to create a new solution (Hammond 1990; Scott et al. 2005).

The execution of such a process can be facilitated by educational efforts aiming at teaching appropriate cognitive strategies and heuristics by studying cases. In a first phase, individuals are first provided with several cases that are somehow similar to the problem to be solved within. Then, they are confronted with the actual case they are supposed to deal with, providing them with independent information, e.g. concerning inherent goals, content, and outcomes. Subsequently, several heuristics can be applied in order to merge the best of previous cases and embed these into the current one's new context (Scott et al. 2005). These steps of different heuristics are outlined in Figure 65; it starts with the identification of those aspects in the case that seem relevant to potential solutions. However, after defining aspired goals and outcomes, a list of strengths and weaknesses of these aspects is developed. On this fundament, an initial action plan for solving the problem in the case is conceived and likely positive and negative outcomes predicted. These provide further information for revising the initial model to a final solution. As often stated for cognitive process models, the stages are highly intertwined and many feedback loops could be integrated in a more sophisticated model.

Step	Heuristics
1.	Identify the critical case characteristics, i.e. operative goals, relevant causes, contingencies, resources, and restrictions.
2.	List the strengths and weaknesses of the cases presented with respect to the attainment of different goals and outcomes.
3.	Create an initial solution model, using goals, relevant causes, contingencies, resources, and restrictions of previous cases.
4.	Predict both the positive and negative action outcomes of your model if it were implemented.
5.	Adjust your initial solution model and formulate a revised solution based on the forecasted outcomes.

Figure 65 Heuristics for Case-Based Category Combination and Reorganisation (based on Scott et al. 2005).

However, there exist further training interventions in order to enhance the ability of opportunity recognition based on this cognitive process. For instance, planning skills were found to facilitate creative information processing and, thus, the ability to produce novel outcomes (Osburn and Mumford 2006); put differently, planning can be seen as the mental simulation of future actions. Again, the skill to plan in a domain is rather experiential or case-based than based on principles (Hammond 1990). Accepting the role of planning for creative thinking, two skills, penetration and forecasting, are of importance for planning performance, and, therefore, qualify as starting point for educational measures.

While penetration refers to the identification of key causes, restrictions, resources, and contingencies in a given situation, forecasting refers to the process of anticipating the implications of the implementation und different conditions (Osburn and Mumford 2006). Ostensibly, a high ability in penetration should help individuals to find key cues or facts in a situation, on which problem-solutions should be built, thereby enhancing the ability to execute the case-based approach outlined above. These cognitive capacities can be developed by training interventions that intend to provide individuals with an understanding of the strategies underlying skilled performance, and, additionally, of how to apply them (Mumford et al. 2003). Accordingly, penetration and forecasting skills could be trained by familiarisation of individuals with strategies that contribute to these processes. This could be followed by practising the steps needed for effective execution of each of these strategies, as summarised in Figure 66 (Osburn and Mumford 2006).

Penetration	Forecasting
1. Identification of the causes operation in a situation: Determine the factors that impact or influence other elements of the situation	1. Projection of positive outcomes: Assess how plan implementation will change a situation and the number and nature of the positive consequences.
2. Identification of critical causes: Determine the causes that have a significant impact or influence or other elements of the situation.	2. Projection of negative outcomes: Assess how plan implementation will change a situation and the number and nature of the negative consequences.
3. Identification of causes having multiple outcomes: Determine causes that influence more than one of the outcomes you hope to attain.	3. Projection of short-term outcomes: Assess the outcomes that will result immediately after implementation of a plan.
4. Identification of causes subject to change or manipulation: Determine the causes that you are able to act on and alter.	4. Projection of long-term outcomes: Assess the outcomes of plan implementation likely to emerge over an extended period of time if planned actions are sustained.
5. Identification of indirect outcomes of change in a cause: Determine the unique outcomes that will occur if multiple causes are alternated at the same time.	5. Projection of likely contingencies and restrictions: asses the conditions required for or likely to shape the successful implementation of a plan.
6. Identification of interdependencies among causes: Determine causes that must occur together if the desired effects are to be attained.	6. Anticipation of likely errors in plan execution: Assess the conditions under which the plan will encounter obstacles or things might go wrong.
7. Evaluation of the relative importance of causes: Evaluate the importance of outcomes influenced by altering a cause.	7. Anticipation of the conditions calling forecasting of backup plan: Assess conditions that might arise and will require an alternative approach to plan implementation.

Figure 66 Strategies for Enhancing Cognitive Planning Skills (Osburn and Mumford 2006, p. 181).

B. Future Research

The results obtained showed significant influences of cognition on entrepreneurial behaviour and, therefore, stands in line with other studies and scholars (e.g. Mitchell et al. 2004, 2007) suggesting the high value cognition research promises for entrepreneurship research in general, and the assessment of opportunity recognition in particular; simply because entrepreneurs are somehow different from a cognitive perspective.

Assuming a general perspective, it was shown that a constructivist approach to the phenomena of truly creative economic agents seems justified, given the fact that economic actors indeed create different situations they feel situated in, a framing process which has significant effects on the actions and decisions they take. Such an ontological argument supports the claims for research on entrepreneurial thinking, in order to overcome shortcomings of other research streams such as personality- or trait-approaches. The present study was an attempt to comply with such demands and do research on cognitive preferences or heuristics under complex conditions with a quite sophisticated method, as demanded by scholars in the discipline (e.g. Bryant 2007).

However, while the present work has chosen a model of creative thinking as reference framework for conceiving opportunity recognition, future research must be more specific about the underlying notion of creativity that too often remains vague and fuzzy; in fact, it has many dimensions and in view of recent results the trivial assertion that creativity per se is a prerequisite for entrepreneurial individuals does not seem acceptable anymore. A solution to this could be in assuming a continuum view on creativity regarding it as expressed in the thinking process' output, as the present work has done.

The present study's findings strongly suggest continuing the path of assessing information processing, heuristics, cognitive preferences, strategies or styles that are typical entrepreneurial in specific situations. Similarly, it could be shown hat elaborated and highly developed methods are available from the cognitive psychologist's toolbox that can be applied in the particular context of economics. However, this general insight that cognitive styles do have explanatory power for entrepreneurial behaviour automatically implies that there are many other heuristics, preferences or styles that could contribute to uncover more about cognitive aspects of entrepreneurs. The author is convinced that a look into literature on such topics in cognitive psychology, usually dealing with cognition in other contexts, promises further concepts that explain individual ways of processing and can be applied to entrepreneurial settings, thereby helping to identify more distinctive cognitive characteristics that describe entrepreneurial thinking and proving that these people are indeed somehow different.

Being more precise, a first implication for future research concerns the construct validity of opportunity recognition as ability: The high reliability and inner coherency of a general construct (including situations one and two) could be seen as a starting point to argue that certain individuals dispose of a general ability of opportunity recognition, independent of the current situation they are confronted with. According to this argumentation, the index k accounting for economic situations could be removed from a general model of opportunity recognition as developed in the present work. In other words, the general statement that there exist more alert individuals than others is indeed supported here. However, at the same time the results indicate that this general aptitude assumes different forms and strengths in different situations.

This implies that subsequent studies must explicitly aim at finding out whether the ability to recognise entrepreneurial opportunities really significantly differs across economic situations, and, if so, what relevant dimensions, on which a reasonable classification could be built on, are. Notwithstanding these efforts still have to come, more fine-grained studies that aim at providing valid implications for further research and entrepreneurship practice should already now clearly point out, which type of entrepreneurial opportunities or economic situations they are dealing with, thereby embracing the nexus between individual and opportunity.

The present study empirically confirms the arguments alleged by other scholars that regulatory focus indeed plays a role in the entrepreneurial process. For future research, three main directions could be proposed: (1) efforts to investigate the dimensions of regulatory focus, (2) efforts to assess its chronic or situative form, and (3) efforts aimed at shedding light on the whole concepts role in different phases of the entrepreneurial process.

Regarding its (1) dimensions entrepreneurship scholars might direct their attention to the role of multiple self-regulatory factors in entrepreneurial decision making and behaviour; i.e. the more demanding research question arises which self-regulatory skills influence an individual's ability to recognise, evaluate, and exploit entrepreneurial opportunities (Bryant 2007)? The present study, as well as others mentioned here, only suggest that an individual's regulatory focus plays a significant role; however, it has been shown that the concept is far more fine-grained, distinguishing between underlying motives, goals and standards, salient outcomes, and means used. This calls for independent investigations of these aspects and their impact on entrepreneurial behaviour, promising far more interesting results and implications, e.g. for entrepreneurship education, than the general investigations available so far.

The considerations as to implications of the findings on promotion focus largely targeted on the (2) difference between its chronic form and such an approach to a particular situation, thereby already hinting at the significance further insights in this regard might have. If more is known about the influence these different levels have in taking entrepreneurial decisions, educational measures can be adjusted to these requirements in order to positively influence entrepreneurial abilities.

Further to this, upcoming research efforts could focus on the question whether the role of regulatory focus (3) varies along the entrepreneurial process and different measures are necessary to deal with this; in the present study, its role in opportunity recognition was investigated and educational measures outlined that facilitate entrepreneurial behaviour at this stage, while other studies focussed on later stages. Subsequent research in the field should elaborate on these initial insights, in finding more details about self-regulatory processes at the entrepreneurial process' different stages. For instance, it has been shown here that even the process of opportunity recognition consists of sub-processes that require different thinking modes, such as divergent and convergent thinking. Hence, there seems a long, but nevertheless promising, way to go in assessing the role of regulatory focus in different information processes.

The crucial role of category combination and reorganisation in conceiving entrepreneurial opportunities has been underlined by theoretical considerations, previous studies, as well as the present research. The central issues that ought to be addressed in upcoming research efforts seem to be (1) which sub-processes are more decisive in producing high-quality, novel problem solutions in which situations, and which (2) preferences and styles in combining categories can be identified in such regard.

Regarding (1) strategies and heuristics, future research should dig deeper into the process entering a more detailed level, e.g. the four sub-processes of (a) identifying central properties or key features of category members, (b) mapping the identified features or properties for one category onto the features of other categories, (c) using shared features to construct a new category, and (d) identifying additional feature or properties of category members through elaboration. In fact, studies in related fields suggest that different strategies or approaches to category combination and reorganisation produce significantly different results measured by quality and originality of the problem solution in a given problem situation (e.g. Scott et al. 2005). Hence, it could be investigated which heuristics and knowledge structures are more innovative in which economic situation? Such research approaches would follow the postulation made by many scholars that distinguishing types of economic situations opening the road for entrepreneurial opportunities is necessary; i.e. it must be accounted for the nexus of opportunity and individual.

The present study has not investigated (2) individual styles in category combination and reorganisation due to methodological limitations in assessing such; however, scholars might soon be able to identify individual preferences in the sub-processes mentioned. As soon as this is possible, entrepreneurship scholars should test for relationships between cognitive styles in category combination and reorganisation; they should explicitly consider this dimension since it has been shown that the execution of combinational information-processes, such as case-based or analogical approaches, offer a variety of opportunities to teach and influence such cognitive processing, and, thereby, probably also entrepreneurial abilities such as opportunity recognition.

C. Summary

The present worked was dedicated to introduce a general cognitive model of opportunity recognition and take advantage of this fundament for investigating individual differences in information processing. If this ‘problem’ has really been solved in a creative manner producing a desirable novel outcome will be judged by the future and the scientific community that might, or might not, deal with the approach chosen.

It has been drawn on psychological theories and methods in order to open the black box of the human mind in economic situations. Principally it is a model in a subjectivist tradition that does, nevertheless, not intend to ex ante predict the emergence of future opportunities on certain chunks of information. The justified doubts concerning predictions of novel problem solutions do not apply to the present work since it is based on types of information that build up any human knowledge structure and, thus, provide a sufficiently general unit to assess the mental production of true novelty. Put differently, it can be answered how creative outcomes, i.e. entrepreneurial opportunities, are conceived but not how they look like in a particular instance.

Besides providing empirical insights on certain cognitive styles and abilities the work might also contribute to the discipline’s progress by providing a comprehensive cognitive framework for modelling entrepreneurial behaviour in general and opportunity recognition in particular. Previous research was either based on outdated models of thinking or only focused on single processes or styles. It was intended to point out that this framework meets most requirements set by other scholars in the field, such as considering the nexus between individual and opportunity by situating the human mind in specific economic situations.

The empirical study was able to reveal that in the thinking process’ early stages of problem finding or convergent thinking a promotion style of regulatory focus positively influences the ability of opportunity recognition; this also holds true for the ability of combining and reorganising knowledge categories. Nevertheless, causal analysis has taught us that a promotion focus has a direct significant effect on opportunity recognition, apparently not only indirect via some form of creativity. However, these findings actually have an interesting theoretical bottom line: In last consequence the denial of personality- or trait-based approaches in explaining entrepreneurial behaviour, and fruitful research on cognitive processes, imply that there does not really exists a nexus between opportunity and individual, but rather - from a cognitive constructivist perspective - between an economic situation an particular cognitive processes; the starting point of such research is the cognitive process and related issues such as cognitive styles and, in a way, entrepreneurs are simply those individuals executing such thinking.

By no means, dealing with the two concepts of regulatory focus and category combination and reorganisation almost exclusively shall suggest that other cognitive constructs are of less importance for opportunity recognition or entrepreneurial behaviour. In fact, cognitive styles can assume a variety of forms and can serve as distinctive factor for individual thinking in many dimensions: for instance, regarding field dependence or field independence, type of scanning, breadth of categorisation, way of conceptualising, cognitive complexity or simplicity, degree of reflectiveness or impulsivity, degree of levelling or sharpening, flexibility of control, as well as tolerance for incongruous or unrealistic experiences (Hoover and Feldhusen 1994). This means that preference types or styles, which were found to be insignificant in the present study, might actually be important in explaining entrepreneurial behaviour as well, but were simply not detected as such due to the author's conceptual or methodological insufficiencies.

Similarly, the suggestions aimed at contributing to entrepreneurship education should be handled with some caution: Although there are convincing arguments for their principal correctness, before integrating modules dealing with such topics into curricula, they must be investigated more thoroughly in order to find out, how successful entrepreneurs really think and, then, how this can be taught. In summary, the results of the present study should rather be considered as another piece of evidence hinting at the potential of entrepreneurial cognition research for helping the whole discipline entrepreneurship research to mark its boundaries and find appropriate measures to help individuals to start a business.

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VIII. Appendix

SURVEY QUESTIONS FOR PREFERENCES IN PROBLEM CONSTRUCTION, INFORMATION ENCODING, AND CATEGORY SELECTION

These are the answer options developed by panel I for assessing subjects preference for types of information in the cognitive processes of problem construction, information encoding, and category Selection. The question or stimuli asking for participants' answer or response is only given for the first example of each cognitive process since always the same for each problem situation.
The answer options were presented in random order and, of course, no information was provided, which answer options represents which type of information.

II. Problem Construction

Generelle Aufgabenstellung: Nachfolgend beginnt das Experiment mit dem 1. von 4 Aufgabenblöcken. Dabei werden Sie mit 4 verschiedenen Problemsituationen konfrontiert. Nachdem eine solche Problemsituation beschrieben wurde, finden Sie unter der Beschreibung eine Auswahl von Antwortmöglichkeiten. Diese beschreiben mögliche Vorgehensweisen, die aus dieser Situation erwachsen können.
Bitte geben Sie für jede dieser 4 Situationen die 2 Möglichkeiten an, die für Sie am ehesten zutreffend wären, wenn Sie sich in der beschriebenen Situation befinden würden. Bitte beachten Sie, dass wir an Ihrer persönlichen Meinung interessiert sind; es gibt keine "richtigen", "falschen", "besseren" oder "schlechteren" Antwortmöglichkeiten in diesem Aufgabenblock.

III. General Domain

Situation 1: Sie wohnen einer wichtigen diplomatischen Veranstaltung bei, die vom Außenministerium veranstaltet wird. Sie bemerken, dass ein Bekannter von Ihnen, der ein wenig zu viel getrunken hat, beginnt, den Botschafter eines wichtigen Landes und andere Gäste zu belästigen.

***Aufgabe**: Bitte wählen Sie die **2** Möglichkeiten aus, wie Sie persönlich am ehesten versuchen würden, diese Situation zu meistern!*

Information: „Wie kann ich..."

herausfinden, ob meine Bekannter sich absichtlich so verhält?
herausfinden, wie bald mein Bekannter plant, die Veranstaltung zu verlassen?
dem Botschafter sein Verhalten vor dem Hintergrund deutscher Traditionen erklären?
herausfinden, wann die Veranstaltung zu Ende ist?

Alternative Ziele: „Wie kann ich...."

meinen Bekannten dazu bringen, uns mit einem Volkstanz zu unterhalten, den er im Ausland gelernt hat?
sicherstellen, dass er so etwas nie wieder macht?
diese Situation in ein kurze Theatereinlage verwandeln?
mich verhalten, als ob ich diese Person nicht kenne?

Alternative Handlungen: „Wie kann ich...."

jemanden finden, der den Botschafter in ein anderes Gespräch verwickelt?
meinen Bekannten dazu bewegen, sich vom Botschafter zu entfernen und sich bei ihm zu entschuldigen?
Kellner überzeugen, meinem Bekannten nur noch nicht-alkoholische Getränke zu geben?
dazu zu bringen, die Veranstaltung zu verlassen?

Einschränkung/Restriktion: : „Wie kann ich...."

mich hinzugesellen und das Gesprächsthema wechseln, so dass niemand verärgert wird?
es schaffen, nicht die Aufmerksamkeit des Botschafters zu erregen, während ich meinen Bekannten von ihm entferne?
Es schaffen, dass mein Bekannter sein Getränk nicht über dem Botschafter ausschüttet?
mich so verhalten, dass der Botschafter und die anderen Gäste nicht verärgert werden?

Situation 2: Sie wurden auserwählt, ihr Land in Ihrer Lieblingsdisziplin bei den olympischen Spielen zu vertreten. Sie sind eine der größten Medaillenhoffnungen, aber ihr Arzt hat Ihnen geraten, sich sofort einer Operation zu unterziehen, oder eine schwerwiegende Verletzung zu riskieren. Allerdings würde diese Operation bedeuten, dass sie nicht an den olympischen Spielen teilnehmen können.

Information: „Wie kann ich..."

herausfinden, ob und wie andere Sportler eine solche Situation gemeistert haben?
herausfinden, ob ich durch spezielles Training den Ausbruch der Verletzung vermeiden kann?
herausfinden, ob verletzte Athleten dennoch viel Geld verdienen können?
herausfinden, ob ich die olympischen Spielen dennoch gewinnen kann?

Alternative Ziele: „Wie kann ich....“

meine Bekanntheit nutzen zu verhindern, dass anderen diese Situation erspart bleibt?
verhindern, dass ich entmutigt werde?
meine Gegner verunsichern, indem ich Reporter überzeuge, ich sei nicht verletzt?
den olympischen Spielen als Zuschauer beiwohnen, wenn ich schon nicht teilnehmen kann?

Alternative Handlungen: „Wie kann ich....“

gelange ich an modernste (legale) Hilfsmittel, so dass ich teilnehmen und gewinnen kann?
eine bessere Lösung finden?
es schaffen, dass die olympischen Spiele nach hinten verlegt werden?
meinen Trainer und Arzt davon überzeugen, dass sie mich teilnehmen lassen?

Einschränkung/Restriktion: : „Wie kann ich....“

diese Entscheidung treffen, so dass es für das gesamte Team am besten ist?
teilnehmen, aber nicht verletzt werden?
mich selber davon überzeugen, dass die Verletzung eine Absage rechtfertigt?
mein Land nicht im Stich lassen?

Situation 3: Sie sind Rektor eine Grundschule. Einer der Schüler hat eine Schlange mit in die Schule gebracht, diese wird nun vermisst.

Information: „Wie kann ich...“

herausfinden, wie gefährlich die Schlange ist und ob externe Hilfe benötigt wird?
herausfinden, um welche Art von Schlange es sich handelt, und ob sie für Menschen gefährlich ist?

herausfinden, ob Tränengas die Schlange aus ihrem Versteck lockt?
herausfinden, wie die Schlange abhanden gekommen ist?

Alternative Ziele: „Wie kann ich....“

in eine Lernerfahrung für die Schüler verwandeln?
die Schulregeln verbessern, was das Mitbringen von Tieren betrifft?
in Zukunft Schulungen gegen die Angst vor Schlangen für Lehrer und Schüler einführen?
verhindern, dass ich die direkte Verantwortung übernehmen muss?

Alternative Handlungen: „Wie kann ich....“

einen Biologen, der sich mit Schlangen auskennt, diskret um Hilfe bitten?
eine systematische Suche nach der Schlange organisieren?
einen Schlangenbeschwörer finden, der die Schlange mit Musik anlockt?
das Problem einfach ignorieren?

Einschränkung/Restriktion: : „Wie kann ich....“

diese Situation händeln, ohne dass jemand verletzt wird (inklusive der Schlange)?
die Schlange finden, ohne das eine Panik ausbricht?
eine „Maus-im Aquarium“-Falle aufstellen, ohne das jemand davon etwas mitbekommt?
eine Durchsage machen, ohne dass jemand Angst bekommt?

Situation 4: Sie sind im Rahmen eines Seminars mit einer Gruppenarbeit beauftragt, die 25% der Endnote ausmacht. Ein Mitglied ihrer Gruppe ist ohne Grund nicht zu Gruppentreffen erschienen und hat seinen Teil der Gruppenarbeit noch nicht vorangetrieben. Zudem haben Sie Probleme ihn zu erreichen. Die gesamte Arbeit muss in 2 Wochen abgeben werden.

Information: „Wie kann ich...“

herausfinden, was diese Person motiviert seine Arbeit zu machen?
einen Rat des Seminarleiters bekommen?
herausfinden, ob der Seminarleiter ihm aufgetragen hat, sich so zu verhalten, um die anderen Gruppenmitglieder zu testen?
herausfinden, was der Seminarleiter tun wird, wenn die Arbeit nicht fristgerecht abgegeben

wird?

Alternative Ziele: „Wie kann ich....“

lernen, Frühwarnzeichen zu erkennen, wenn jemand sich nicht voll einbringt?
meine Leistung auf eine andere Weise erbringen (um den Schein zu erlangen)?
zusätzliche Punkte bekommen, da wir das Projekt mit weniger Gruppenmitgliedern gestemmt haben?
Seminare meiden, die Gruppenarbeiten beinhalten?

Alternative Handlungen: „Wie kann ich....“

mit knappem Personal innerhalb der verbleibenden Zeit das Beste aus dem Projekt machen?
die Arbeit am besten innerhalb der Gruppe umverteilen, wenn er es nicht schafft, seinen Teil der Arbeit zu erbringen?
dieses Gruppenmitglied gegen ein anderes aus einer anderen Gruppe austauschen?
dieses Gruppenmitglied loswerden?

Einschränkung/Restriktion: : „Wie kann ich....“

mit der Situation umgehen, so dass alle als Gewinner hervorgehen, auch das unmotivierte Gruppenmitglied?
mit der Situation umgehen, ohne dass die Störung der Gruppe zu groß wird?
mit der Situation umgehen, ohne ihm das Gefühl persönlichen Versagens zu vermitteln?
Mit der Situation umgehen, ohne den Seminarleiter mit einzubeziehen?

IV. Entrepreneurship Domain

Situation 1: Sie haben eine Geschäftsidee entwickelt und fest vor, diese auch in die Tat umzusetzen. Sie lesen nun in der Zeitung, dass ein großes Unternehmen ein ähnliches Vorhaben plant.

Information: „Wie kann ich...“

an Information gelangen, welche Auswirkungen diese für meine eigenen Geschäftsprognosen hat?

herausfinden, ob ich dennoch einen USP (ein Alleinstellungsmerkmal) besitze?
herausfinden, wer aus diesem Unternehmen mir persönlich bekannt ist, um genaure Einblicke in das Unternehmen zu erhalten?
an Informationen gelangen, die das Konkurrenzunternehmen bei den Steuerbehörden kompromittieren?

Alternative Ziele: „Wie kann ich....“

eine Kooperation mit dem Wettbewerber als Win-Win-Situation gestalten?
meinen eigenen Markteintritt beschleunigen und Markteintrittsbarrieren errichten?
das große Unternehmen dazu bringen mich als Manager ihres Unternehmens für das Vorhaben anzustellen.
auf andere Art und Weise mein zukünftiges Einkommen sichern?

Alternative Handlungen: „Wie kann ich....“

die entscheidenden Lieferanten zu Exklusivlieferanten für mein Geschäftsvorhaben machen.
meine Geschäftsidee patentieren lassen?
einen anerkannten Experten dazu bewegen, das Konzept des Konkurrenten öffentlich zu kritisieren?
andere Zeitungen davon abhalten, auch davon zu berichten damit sich meine Aussichten nicht noch mehr verschlechtern?

Einschränkung/Restriktion: : „Wie kann ich....“

meine Geschäftsidee so umgestalten, dass sie trotz der Konkurrenz so erfolgreich sein wird wie die ursprüngliche Idee ohne Konkurrenz?
meinen Lebensunterhalt anderweitig absichern?
den Arbeitsprozess des großen Unternehmens verlangsamen?
aus dem Geschäft wieder aussteigen?

Situation 2: Ihr neugegründetes Unternehmen beansprucht Sie sehr. Sie sind jeden Tag 12-14 Stunden in der Firma und auch die Wochenenden verbringen Sie größtenteils dort. Ihre langjährige(r) Lebensgefährtin (e) scheint diese Situation nicht mehr lange mitzumachen.

Information: „Wie kann ich...“

lernen, Arbeit zu delegieren?
mir externe Unterstützung zu Hilfe holen?
meiner Freundin einen ähnlich anspruchsvollen Job verschaffen?
Unternehmensbereiche schließen?

Alternative Ziele: „Wie kann ich....“

meiner(m) Freund(in) eine Perspektive bieten, indem ich einen fähigen Stellvertreter einstelle, der mich auf Dauer in der Firma entlastet?
meine Einstellung zur Arbeit verändern?
meine(n) Freund(in) motivieren, genau so viel Engagement in ihrem/seinem Job zu zeigen?
meine(n) Freund(in) dazu bringen, sich weniger aufzuregen und zu beschweren?

Alternative Handlungen: „Wie kann ich....“

meine Arbeitsprozesse optimieren, um mehr Zeit zu haben?
ihr einen Job in der Firma vermitteln, der ihr Spaß macht, so dass wir mehr Zeit gemeinsam verbringen?
meine EDV-Fähigkeiten verbessern, um den Zeitaufwand bei gleicher Leistung zu verringern?
mich von meiner(m) Freund(in)trennen?

Einschränkung/Restriktion: : „Wie kann ich....“

meine Arbeit mehr nach Hause verlagern, um wenigstens zu Hause zu sein?
meine(n) Freund(in) dazu bringen, mich zu heiraten, um damit ihre Austrittsbarrieren zu erhöhen?
meine(n) Freund(in) ein Hobby nahe bringen, dass sie/ihn an Abenden und Wochenenden stark beansprucht, so dass sie/er gar nicht merkt, dass ich nicht da bin?
mir eine Partnerin suchen, die mehr Verständnis aufbringt?

Situation 3: Ihr neugegründetes Unternehmen hat bisher nur wenige Großkunden, die deswegen sehr wichtig für Sie sind. Einer dieser Kunden ist verärgert, weil Sie zu einen vereinbarten Termin nicht liefern werden können.

Information: „Wie kann ich...“

ein innerbetriebliches Frühwarnsystem installieren, um zukünftig Engpässe früher festzustellen?
dieses Problem in Zukunft schneller erkennen und hierbei proaktiv agieren?
ohne diesen Kunden am Markt überleben?
herausfinden welche Konsequenzen der Lieferausfall für den Kunden wirklich hat, um seine Verärgerung einschätzen zu können?

Alternative Ziele: „Wie kann ich....“

versuchen, mein Kundenportfolio zu vergrößern, um meine Abhängigkeit von einzelnen Kunden zu verringern?
meine Prozesse beschleunigen, um den Termin halbwegs einzuhalten?
ihn dazu bewegen, dass er mir einen weiteren Auftrag gibt, um ihm von Gegenteil zu überzeugen?
mittelfristig kleinere Kunden gewinnen, deren individuelles Bestellverhalten weniger Einfluss auf meinen Erfolg hat?

Alternative Handlungen: „Wie kann ich....“

dem Kunden helfen, den Schaden konkret zu minimieren?
kurzfristige Arbeitskräfte einstellen, um in mehreren Schichten arbeiten zu können?
einen anderen Lieferanten dazu bringen, dass er einmalig termingerecht liefert und somit für mich einspringt, so dass dem Kunden keine Nachteile entstehen?
den Verantwortlichen in meinem Unternehmen ausfindig machen, um ihn zu feuern und ein Zeichen zu setzen?

Einschränkung/Restriktion: : „Wie kann ich....“

meine internen Systeme so verändern, dass so etwas nie wieder passiert und auch dem Kunden dies signalisiert wird?
die Aufträge weniger wichtiger Kunden so aufschieben, dass ich den Großkunden doch noch bedienen kann?
dem Kunden erklären, dass überraschenderweise der Termin doch gehalten werden kann, um Bedenkzeit rauszuschlagen. Es wird mir schon eine Lösung einfallen?
mich eine Zeit lang verleugnen lassen, so dass er mich die nächsten Tage nicht erreichen und beschimpfen kann?

Situation 4: Ihr neugegründetes Unternehmen stellt ein hochmodernes biotechnologisches Produkt her. Auf einem Kongress an dem Sie teilnehmen wird diese Technologie in einer Diskussion als unmoralisch an den Pranger gestellt.

Information: „Wie kann ich..."

die Kritiker mit Parallelen zu anderen erst umstrittenen Technologien zum Verstummen bringen?
herausfinden was die Kritiker zu ihren Aussagen motiviert? (Hätten sie selber gerne den Triumph gehabt?)
Teilnehmer aus den Vortests zu emotionalen Berichten über die Behandlungserfolge bringen?
deutlich machen, dass die Vorteile die Nachteile bei weitem überwiegen?

Alternative Ziele: „Wie kann ich...."

deutlich machen, dass diese Technologie in Zukunft eine Menge Arbeitsplätze schaffen und nachhaltig sichern wird?
in der Diskussion die tatsächlichen, höchstmoralischen Hintergründe der Innovation richtig stellen?
die Diskussion durch eine komödiantische Einlage beenden?
deutlich machen, wie viel Geld sich damit verdienen lässt?

Alternative Handlungen: „Wie kann ich...."

nicht nur die Aufmerksamkeit auf mich ziehen, sondern auch die Diskussion zur Vorstellung meines Produktes nutzen?
zeigen, dass das eigene Produkt gerade am wenigsten unmoralisch ist?
mit dieser angenommenen Unmoralität werben?
die Diskussion möglichst theatralisch verlassen, um meine Empörung zum Ausdruck zu bringen?

Einschränkung/Restriktion: : „Wie kann ich...."

den Referenten in Widersprüche verwickeln und damit sein Glaubwürdigkeit in Frage stellen?
es meinen Gegnern verbieten, derartig über mein Produkt zu sprechen?
meine Unternehmen umfirmieren und das Produkt umbenennen?
schnell das Thema der Diskussion wechseln?

V. Information Encoding

Generelle Aufgabenstellung: Bitte widmen Sie sich jetzt dem nächsten Aufgabenblock. Jede der 4 Aufgaben im nachfolgenden Aufgabenblock ist wie folgt aufgebaut:

Auf der 1. Seite wird die Situation erläutert, in der Sie sich befinden.

Auf den 6 nachfolgenden Seiten finden Sie zusätzliche Informationen, die Sie bei Ihrer Problemlösung unterstützen sollen.

Auf der 8. Seite können Sie Ihre persönliche Problemlösung in das dafür vorgesehene Textfeld eintragen.

Bitte beachten Sie: Sie können sich jede Seite beliebig lange und beliebig oft anschauen. Benutzen Sie einfach die beiden Pfeile Ihres Browsers, um zwischen den Seiten vor und zurück zu wechseln! Selbstverständlich können Sie auch weiterhin den "next"-Button nutzen, um zur nächsten Seite zu gelangen.

General Domain

Situation 1: Sie sitzen in einer Straßenbahn und es sind nicht mehr viele Menschen unterwegs. Sie beobachten, wie drei Jugendliche in unmittelbarer Nähe einen Streit mit einem Farbigem provozieren und ihn massiv bedrohen.

Aufgabe: Sie bekommen auf dieser Seite eine Situation beschrieben. Auf den nachfolgenden Seiten finden Sie weitere Informationen dazu. Sie können sich die Informationen auf den Seiten beliebig oft und lange ansehen.

Zusätzliche Sachinformationen	Das Viertel, das sie durchfahren ist für seine hohe Kriminalitätsrate berüchtigt.
Für die Lösung irrelevante, widersprüchliche Informationen	Die Straßenbahn fährt mit ziemlicher hoher Geschwindigkeit.
Wesentliche Sachinformationen	Sie sehen genau, dass die Jugendlichen bewaffnet sind.
Wesentliche	Sie könnten die Kabine des Zugführers leicht erreichen, ohne dass sie

Sachinformationen	große Aufmerksamkeit dabei erregen würden.
Wesentliche Sachinformationen	Die Jugendlichen tragen eindeutig rechtsradikale Symbole auf Ihrer Kleidung.
Prinzipien u.U. sachdienlich für die Lösung	Sie wissen, dass Zugführer für den Umgang mit solchen Situationen ausgebildet und geschult werden.

Situation 2: Sie und ihr Lebenspartner befinden sich im Keller Ihres Hauses. Sie wissen, dass ihr Partner panische Angst vor Mäusen hat. Unglücklicherweise haben sie eine ganze Menge Mäuse entdeckt, die Ihnen beiden den Weg aus dem Keller „versperren".

Ziele der Lösung	Ihr Partner darf die Mäuse unter keinen Umständen entdecken.
Sachdienliche, aber nicht essentielle Informationen zur Lösung	Eigentlich wissen Sie, dass Mäuse nicht gefährlich sind und auch Ihrem Partner dies prinzipiell bewusst ist.
Wesentliche Sachinformationen	Ihr Partner ist beschäftigt und schenkt dem Teil des Raums, in dem sich die Mäuse befinden, momentan keinerlei Aufmerksamkeit.
Wesentliche Sachinformationen	In greifbarer Nähe befindet sich ein Besen.
Wesentliche Sachinformationen	Die Mäuse befinden sich ganz in der Nähe ihres augenscheinlichen Versteckes (einem Mäuseloch in der Wand), in das sie verschwinden könnten.
Restriktionen, die bei der Lösung berücksichtigt werden sollten	Sie sind am gleichen Abend noch bei Freunden eingeladen und müssen in spätestens einer halben Stunde aufbrechen.

Situation 3: Sie haben vor wenigen Sekunden einen Diebstahl im Kaufhaus beobachtet. Ein junger Mann hat sich CDs in die Jacke gesteckt. Er macht auf Sie einen gestressten, irgendwie furchteinflößenden Eindruck.

Zusätzliche Sachinformationen	Es könnte sich um einen Drogenabhängigen handeln.
Für die Lösung irrelevante, widersprüchliche Informationen	Sie konnten nicht erkennen, ob er sich um wertvolle Warte handelt.
Wesentliche Sachinformationen	Ganz in der Nähe befindet sich eine Verkäuferin.
Wesentliche Sachinformationen	Sie befinden sich im 4. Stock des Kaufhauses, es ist also noch ein weiter Weg aus dem Gebäude heraus.
Wesentliche Sachinformationen	Sie sehen, dass die Verkäuferin in Ihrer Nähe mit einem Funkgerät ausgestattet ist.
Prinzipien u.U. sachdienlich für die Lösung	Kaufhäuser beschäftigen immer Wachdienste und ausgebildetes Sicherheitspersonal.

Situation 4: Im vollbesetzten Flugzeug setzt sich ein schwergewichtiger Mann auf den Platz direkt neben Sie. Er stinkt unerträglich, aber es ist kein anderer Platz in der Maschine frei. Was können Sie tun?

Ziele der Lösung	Sie können den Gestank in dieser Form nicht ertragen.
Sachdienliche, aber nicht essentielle Informationen zur Lösung	Der Flug wird etwa 10 Stunden dauern.
Wesentliche Sachinformationen	Das Flugzeug ist vollkommen ausgebucht und es ist kein anderer Platz frei.
Wesentliche Sachinformationen	Die Stewardess ist sehr hilfsbereit.
Wesentliche Sachinformationen	Für solche Fälle haben große Fluggesellschaften häufig Deodorants für Fluggäste an Board.
Restriktionen, die bei der Lösung	Der Mann ist aus einem anderen Kulturkreis und könnte sich in

berücksichtigt werden sollten	seinem Stolz oder in seiner Ehre gekränkt fühlen.

VI. Entrepreneurship Domain

Situation 1: Sie stellen fest, dass Ihr Gesamtumsatz in den vergangenen Monaten permanent sinkt. Um diese Entwicklung zu stoppen, müssen Sie den Gründen für die negative Entwicklung auf die Spur zu kommen und zu reagieren. Was könnten Sie tun bspw. tun, um die Entwicklung zu stoppen?

Zusätzliche Sachinformationen	Der Cashflow den Ihr Unternehmen generiert ist dennoch positiv.
Für die Lösung irrelevante, widersprüchliche Informationen	Ihre Bank teilt Ihnen mit, dass Ihre gute Bonitätseinstufung gefährdet ist.
Wesentliche Sachinformationen	Einer Ihrer Großkunden verrät Ihnen seine wesentlichen Kritikpunkte, insbesondere beschwert er sich über zu kurzen Zahlungsziele, die Sie einräumen.
Wesentliche Sachinformationen	Eine Konkurrenzanalyse einer studentischen Unternehmensberatung zeigt deutliche Schwächen Ihres Kundenservices auf.
Wesentliche Sachinformationen	Eine Ertragsanalyse zeigt deutlich, dass nicht alle Produkte von dem Umsatzrückgang betroffen sind.
Prinzipien u.U. sachdienlich für die Lösung	Der Umsatz ist nicht das ausschlaggebende Kriterium, nachdem jede Entscheidung ausgerichtet werden muss. Ebenso wichtig sind Gewinn, Cashflow, etc.

Situation 2: Ihre Kunden wollen rasch beliefert werden. Deshalb haben Sie von allen Artikeln größere Mengen auf Vorrat, so dass Sie auch die größtmögliche Nachfrage befriedigen könnten. Ihr Bankberater meint, dass Ihre Vorsorge zu viel Kapital bindet. Andererseits ist bei Ihnen der Kunde König. Was werden Sie in dieser Situation tun?

Ziele der Lösung	Es ist wichtig die optimale Lagermenge zu bestimmen, damit die Opportunitätskosten durch Vorratshaltung minimiert werden.
Sachdienliche,	Auch meine Konkurrenten haben dasselbe Problem.

aber nicht essentielle Informationen zur Lösung	
Wesentliche Sachinformationen	Ein Freund empfiehlt Ihnen den Einsatz einer einfach zu bedienenden Software zur Verbesserung Ihrer logistischen Organisation.
Wesentliche Sachinformationen	Eine Analyse ergibt, dass die von Kunden akzeptierte Lieferzeit zwischen den Produkten stark variiert.
Wesentliche Sachinformationen	Ihr Bankberater hat berechnet, dass schon die Reduzierung von Beständen einiger Ihrer Produkte die Kapitalbindung merklich verringern würde.
Restriktionen, die bei der Lösung berücksichtigt werden sollten	Einige Ihrer Kunden sind Hersteller und eine einmalige verspätete Lieferung der Kunden würde eine Auflösung des Lieferantenvertrages bedeuten.

Situation 3: Sie führen ein Computer- und Systemhaus. Sie bieten neben Individualsoftware auch Computerhardware in Form von PCs und Großrechnern. In den letzten zwei Monaten war der Verkauf der PCs rückläufig, die Software-Auftragslage start zunehmend und der Verkauf von Großrechnern gleichbleibend bei fallenden Preisen. Was tun Sie?

Zusätzliche Sachinformationen	Sie erfahren durch einen anderen Händler, dass es allen Anbietern im Moment genau so geht.
Für die Lösung irrelevante, widersprüchliche Informationen	Neue Generationen von Technologien lösen immer schneller Ihre Vorgänger ab.
Wesentliche Sachinformationen	Sie wissen aus Erfahrung, dass Ihr PC-Absatz durch gezielte Werbemaßnahmen gesteigert werden kann.
Wesentliche Sachinformationen	Eine Marktstudie einer großen Computerzeitschrift verspricht die Erholung des PC-Marktes innerhalb des nächsten Jahres.
Wesentliche Sachinformationen	Die Hersteller von Großrechnern reagieren auf die fallenden Preise und passen auch die Handelspreise nach unten an.
Prinzipien u.U. sachdienlich für die Lösung	Märkte unterliegen immer konjunkturellen Zyklen, somit muss sich diese negative Entwicklung nicht zwangsläufig fortsetzen.

VII. Situation 4: Sie eröffnen am 1.1. des nächsten Jahres ein Einzelhandelsgeschäft. Sie erwarten Ende des Jahres dann so gut etabliert zu sein, dass Sie drei Vollzeitkräfte benötigen werden. Was werden Sie tun?

Ziele der Lösung	Die Mitarbeitstruktur sollte eine stufenweise Anpassung auf steigende Nachfrage zulassen, aber keine ungenutzten Mitarbeiterressourcen binden.
Sachdienliche, aber nicht essentielle Informationen zur Lösung	Das Angebot an qualifizierten Mitarbeitern ist sehr hoch.
Wesentliche Sachinformationen	Einmal eingestellt, ist es augrund der rechtlichen Lage nicht einfach, Vollzeitkräfte zeitnah wieder zu entlassen.
Wesentliche Sachinformationen	Eine Vollzeitkraft ist jedoch günstiger als zwei Halbtagskräfte.
Wesentliche Sachinformationen	Sie können nicht abschätzen, ob Ihr Geschäft nach Ablauf des nächsten Jahres noch weiter wachsen wird.
Restriktionen, die bei der Lösung berücksichtigt werden sollten	Wenn Sie zu wenig Personal beschäftigen, leidet Ihr Service und damit mittelfristig auch Ihr Geschäft.

VIII. Category Selection

Generelle Aufgabenstellung: Bitte widmen Sie sich jetzt dem nächsten Aufgabenblock. Jede der folgenden 5 Aufgaben ist wie folgt aufgebaut:

Bei jeder Aufgabe bekommen Sie wiederum die Beschreibung einer Situation. Auf der gleichen Seite, unter der Situationsbeschreibung, finden Sie 8 Antwortmöglichkeiten, welche eine mögliche Handlung in dieser Situation beschreiben. Aus diesen wählen Sie bitte die 4 Handlungsmöglichkeiten aus, die Sie persönlich für sich am ehesten in Betracht ziehen würden.

(Hinweis: Bitte beachten Sie, dass wir an Ihrer persönlichen Meinung interessiert sind; es gibt keine "richtigen", "falschen", "besseren" oder "schlechteren" Antwortmöglichkeiten in diesem Aufgabenblock.)

(Note: Most of the scenarios are based on short stories in Shorris, E. (1981), The oppressed middle: Politics of middle-management/scenes from corporate life. New York: Anchor/Press.)

IX. General Domain

Situation 1

Die verrechneten Beträge auf dem Spesenkonto waren unglaublich hoch. Das waren nicht mehr nur die üblichen Geschäftsessen oder Theaterkarten. Dieser eine Außendienstmitarbeiter gab über 200.000 Euro im Jahr aus; das war mehr als das gesamte Reisekosten- und Bewirtungskostenbudget der gesamten Filiale. Die Belege waren zwar alle vorhanden, aber die Verhältnismäßigkeit der Ausgaben war schon sehr fraglich: trotzdem, dieser Außendienstmitarbeiter war früher enger Mitarbeiter des Staatssekretärs und seine Beziehungen zur Berliner Politik waren beeindruckend.

Als der Leiter der Außenstelle die Spesenkonten seiner Außendienstmitarbeiter durchsah, fragte er sich, ob er wirklich ein Spesenkonto abzeichnen solle, dass fast jeden Tag Abendessen für 1000 Euro aufführt. Letzten Endes verkaufte seine Abteilung Maschinen an Hersteller sowie Zulieferer und kein anderer Außendienstmitarbeiter gab auch nur ein Zehntel dieser Summe aus.

Als besagter Außendienstmitarbeiter vor 2 Jahren in die Berliner Filiale wechselte, hatte er deutlich gemacht, dass die dort sonst üblichen Regelungen hinsichtlich der Spesen für ihn nicht gelten würden, da er sich nur dem stellvertuenden Geschäftsführer in der Firmenzentrale gegenüber zu verantworten habe. Als der Filialleiter den Außendienstmitarbeiter auf die vereinbarten Ziele der Verkaufszahlen, die nicht erreicht wurden, ansprach, antwortete dieser, dass er sich an den stellvertretenden Geschäftsführer wenden solle, wenn es ein Problem gäbe.

Ein wenig naiv, fragte der Filialleiter den Außendienstmitarbeiter, warum er nicht direkt für den stellvertretenden Geschäftsführer arbeite. Dieser antwortete, dass der die Kosten für Lobbyarbeit niedrig halten wolle. Als der Leiter um ein schriftliche Bestätigung dieser Aussage bat, lachte der Außendienstmitarbeiter ihm bloß ins Gesicht. In diesem Moment realisierte der Filialleiter, dass er selber die Verantwortung für die hohen Spesen übernehmen oder die Angelegenheit ans Tageslicht bringen müsse.

Aufgabe: Bitte wählen Sie die 4 Möglichkeiten, welche Sie persönlich favorisieren!

Generelle Prinzipien

- Unschuldige werden leicht Opfer politischer Systeme.
- Was ethisch und was praktisch ist, ist nicht immer das Gleiche.

Spezifische Planhandlungen

- Der Filialleiter muss sich entscheiden, ob er die Verantwortung und die drohenden

Konsequenzen übernimmt oder die Angelegenheit aufdeckt.

- Der Filialleiter sollte in Erwägung ziehen, den Hauptgeschäftsführer in der Firmenzentrale auf die Sache anzusprechen und versuchen, so seinen Job zu retten.

Langfristige Ziele

- Finanzielle Unverantwortlichkeit kann ein schlechtes Bsp. für andere Außendienstmitarbeiter setzen.
- Ausgaben und Beziehungen zu thematisieren könnte der Firma schaden.

Bewertung Dritter

- Der Filialleiter sollte ethische Aspekte, die in Berlin üblichen Lobbygebräuche und persönliche Karriereüberlegungen in die Entscheidung mit einbeziehen.
- Der Filialleiter könnte den stellvertretenden Geschäftsführer um einen zusätzlichen Außendienstmitarbeiter für seine Filiale bitten, um den Mangel an Produktivität durch besagten Außendienstmitarbeiter, der nur Lobbyarbeit verrichtet, auszugleichen.

Situation 2 (based on „The Maze“, pp. 166-172)

Der Marketingdirektor des traditionsreichen Unternehmens, war nun schon seit 37 Jahren dort beschäftigt. Er hatte eine renommierte Universität besucht und dort auch sein Interesse für Philosophie und Kunst entdeckt. Als der neue Marketingvorstand ins Unternehmen kam, da verstanden sich die beiden eigentlich sehr gut. Sicherlich waren sie eher unterschiedliche Charaktere, aber ihre gemeinsame Leidenschaft für spanische Maler und das gemeinsame Diplom der Universität waren nur Ausdruck dafür, dass sie grundsätzlich „auf einer Wellenlänge“ lagen.

Jedoch begann der Marketingvorstand nach einiger Zeit den Direktor immer mehr unter Druck zu setzen. Es wurden Ziele vorgegebenen, die unmöglich zu erfüllen waren. Der Vorstand unterstellte ihm sogar, ein Verhältnis mit seiner Sekretärin zu haben. Nach einigen Monaten hielt es der Direktor nicht mehr aus und kündigte.

Bei seiner Abschiedsparty hatte er leider ein Glas zuviel getrunken und stieß lauthals mit fast jedem auf „das blöde A***** von Marketingvorstand“ an.

Zwei Jahre später trifft der ehemalige Direktor im Flughafencafe einen alten Kollegen aus dem Unternehmen. Nach einem kurzen Gespräch spricht dieser ihn an: „Deine Abschiedsparty war toll, aber dass du so über den falschen Mann hergezogen hast, fand nicht nur ich seltsam.“ „Wieso der Falsche?!“ antwortete der ehemalige Direktor. „Der Marketingvorstand war doch ein großer Anhänger von dir, aber der Vorstandsvorsitzende hat ihn gezwungen, dich aus dem Unternehmen zu drängen.“ „Warum hat mir das den keiner gesagt?!“ brachte der ehemalige Direktor nur noch entsetzt hervor. „Ich dachte du wusstest das, jeder wusste es!“. Der ehemalige Marketingdirektor wurde plötzlich klar, dass er auf dieser Party einen schrecklichen Fehler begangen hatte, den er irgendwie aus der Welt schaffen musste.

Generelle Prinzipien

Die unmittelbar Beteiligten wissen oft weniger als das Umfeld.

Häufig müssen Mitarbeiter die Entscheidungen der Vorgesetzen verantworten und sich in deren Namen (erkannt oder unerkannt) unbeliebt machen.

Spezifische Planhandlungen

Der Marketing-Direktor spricht den Marketingvorstand direkt an. Er klärt das Missverständnis auf und entschuldigt sich bei ihm.

Der ehemalige Marketingdirektor sollte sich bei dem Marketingvorstand entschuldigen.

Langfristige Ziele

Langfristig schadet so eine ungeklärte Angelegenheit immer dem guten Ruf.
Er sollte in seinem jetzigen Unternehmen wenigstens klare und transparente Entscheidungsstrukturen einführen, um die Wiederholung eines solchen Vorfalls zu vermeiden.

Bewertung Dritter

Den Kollegen auf dem Flughafen fragen, ob der Vorstand die Situation richtig einschätzen konnte und seine Verärgerung folglich verstehen konnte.

Den ehemaligen Arbeitskollegen um Rat fragen, mit dem beide viel zu tun hatten.

Situation 3 (based on „Rootlessness", pp. 166-172)

Es war Liebe auf den ersten Blick. Er studierte Maschinenbau und war ganz anders als die Jungs an ihrer Kunstakademie. Sie verbrachten schöne und glückliche Studentenjahre zusammen und heirateten kurze Zeit später. Ursprünglich wollte sie auch ihre eigenen beruflichen Ziele verwirklichen, aber als sie dann mit ihrer ersten Tochter schwanger war, hatte sich das dann doch zerschlagen.

Er war ein guter Ingenieur und machte Karriere in seinem Unternehmen. Nach wenigen Jahren wurde er immer wieder befördert, leider war dies fast immer mit einem Unzug verbunden: in 6 verschiedenen deutschen Städten hatten sie inzwischen gelebt. Die Frau und die Kinder gingen immer mit, ihre Freunde und eigenen Interesse stellten sie hinten an.

Dann kam die große Chance für den Mann. Er sollte in den Vorstand des Unternehmens aufrücken: auf genau jenen Posten, von dem aus man auf den Vorstandsvorsitz gelangte, wenn man sich bewährte. Der Vorstand saß allerdings in den USA. Seine Frau und die Kinder waren es Leid. Sie hatten genug von der Umzieherei, und jetzt auch noch nach Amerika?! Nein, sie wollten nicht. Der Ingenieur musste eine Lösung finden, denn er liebte seine Frau immer noch.

Generelle Prinzipien

Der berufliche Erfolg steht nicht über allem.

Man muss auch Kompromisse eingehen können.

Spezifische Planhandlungen

Herausfinden, welche Tätigkeiten oder Anreize für die Familie in den USA gegeben sind.

Er sollte mit seiner Frau alle Szenarien durchsprechen, inklusive der Konsequenzen.

Langfristige Ziele

Familie und Karriere müssen sich einfach irgendwie unter einen Hut bringen lassen.

Er sollte eine Lösung finden, die sowohl Sicherung der Familie durch Zusammenhalt als auch finanzielle Absicherung ermöglicht.

Bewertung Dritter

Die Frau eines Kollegen, die in den USA gelebt haben, könnte berichten, wie es dort ist.

Er könnte einen Kollegen fragen, wie er diese Aufgabe gemeistert hat.

Situation 4 (based on „Esprit“, pp. 204-208)

Er konnte sich nicht an viel erinnern, was in den letzten tagen passiert war. Ab und an war er wach gewesen, zumindest glaubte er das, und hatte wahrnehmen können, was um ihn herum in dem Krankenhauszimmer passiert war. Aber die Schmerzen übertönten sowieso seine Erinnerungen.

Vier Tage später erklärte der Oberarzt ihm und seiner Frau die Schwere der Magenblutung. Nur knapp sei er dem Tod entronnen und musste sich nun schonen und auf eine lange Genesungsphase einstellen.

Als der Arzt den Raum wieder verlassen hatte, sprudelte es aus ihm heraus. „Dieser Quacksalber. Ich fühle mich schon viel besser. Spätestens in 2 Wochen bin ich wieder in der Firma.“ Er erklärte seiner Frau, wie sehr das Unternehmen in brauche, und selbst wenn nicht, dann würden sie sich schnell jemand anderen suchen, der seinen überaus wichtigen Platz einnähme.

In diesem Moment wurde seiner Frau bewusst, dass er mit seinem Leben spielte, ohne es auch nur zu bemerken.

Generelle Prinzipien

Ein Kranker kann seine Situation selber selten richtig einschätzen.

Gefahren oder Ängste werden häufig verdrängt.

Spezifische Planhandlungen

Sie könnte dem Arzt alles erzählen und ihn bitten, was zu tun.

Sie könnte ihrem Mann noch mal die Gefahren vor Augen führen.

Langfristige Ziele

Sie könnte ihm die möglichen bleibenden Schäden und Risiken für sein Leben vor Augen führen.

Sie könnte ihm deutlich machen, dass er seinen Job mit seiner Gesundheit dann nicht mehr lange machen könnte.

Bewertung Dritter

Sie könnte den Arzt fragen, wie sie sich verhalten soll.

Sie könnte einen Psychologen zu Rate ziehen, wie sie ihn von der Gefahr überzeugen kann.

Situation 5 (based on „Manna", pp. 220-225)

Es war nicht die erste Nacht, die er ihm Büro verbrachte. Aber er war gut in dem was er tat und wenn das Unternehmen die Krise überwinden wollte – und die Chancen dafür standen gut – dann mussten alle hart arbeiten. Er tat das eigentlich immer, denn sein Gehalt wurde zu einem hohen Anteil durch einen variablen Bonus am Endes des Geschäftsjahres ausgemacht, dessen Höhe sich daran bemaß, wie erfolgreich das Unternehmen in diesem Jahr war.
Er brauchte dieses Geld aber auch, denn beide Kinder studierten und wurden von ihm und seiner Frau finanzielle unterstützt. Er hatte seinen Kinder versprochen, dass sie sich voll auf ihr Studium konzentrieren könnten und sich nicht so viel Gedanken um Geld machen müssten. Und die Kinder taten das wirklich und dies zeigte sich auch in dem Erfolg den beide im Studium hatten.

Als der Abteilungsleiter am Endes des Geschäftsjahres die diesjährigen Bonus-Abrechnungen verteilte, traf ihn fast der Schlag: es war nicht nur weniger als erwartet, sonder einfach viel zu wenig, um die Ausgaben zu decken, wenn er die Kinder weiter unterstützen wollte. Aber sollte er sich nun beschweren oder fragen, ob vielleicht ein formaler Fehler unterlaufen sei? Oder würden Sie ihm dann im nächsten Jahr bei der Bonuszahlung noch schlecht dastehen lassen?

Generelle Prinzipien

Vertrauen ist gut, Kontrolle ist besser.

Leistung die immer angeboten wird, wird nicht mehr unbedingt als außergewöhnlich oder überdurchschnittlich anerkannt.

Spezifische Planhandlungen

Er sollte das offene Gespräch suchen, um zu ergründen ob die Minderzahlung auf seine Person oder die wirtschaftliche Lage des Unternehmens zurückzuführen ist.
Er sollte auch mit seinen Kindern und seiner Frau offen über das Problem sprechen, um verschiedene Handlungsalternativen zu finden.

Langfristige Ziele

Er könnte versuchen, dass er in Zukunft einen Arbeitsvertrag erhält, der weniger variabel und von Bonuszahlungen abhängig ist.

Die Sicherung der Arbeitsstelle ist am wichtigsten.

Bewertung Dritter

Er könnte sich mit seiner Frau beraten, wo man einsparen könnte.

Er könnte einige wenige vertraute Kollegen einweihen und Fragen, wie sie mit der Situation umzugehen gedenken.

X. Entrepreneurship Domain

Situation 1 (based on „Movement“, pp. 183-187)

Er hatte dieses Unternehmen selber aufgebaut. Alleine hatte er angefangen in der Scheune eines Verwandten. Nichts und niemand hat ihm dabei geholfen, außer seiner Disziplin und seinen Prinzipien, von denen er nie abgewichen war.
Das Unternehmen war ein stattlicher Konzern geworden und immer noch stand er an der Spitze. Aber die Zeiten hatten sich geändert: früher war alles einfacher, denn das Unternehmen wuchs jedes Jahr und das Geschäft war übersichtlich. Heute drehte sich alles nur noch um Asien: aber nicht nur die großen Absatzmärkte oder die billigen Lohnkosten beschäftigten ihn, vor allem der große japanische Konkurrenz machte seinem Unternehmen zu schaffen.

Hier in Thailand sollte sich nun entscheiden, wie es um die Zukunft des Unternehmens bestellt war. Aber auch die Japaner schliefen nicht. In diesem Land kam man nur durch Beziehung und Bestechung weiter, in diesem Fall war der Kabinettsminister der thailändischen Regierung der ausschlaggebende Faktor. Der würde sich für einen der beiden Anbieter entscheiden und somit das Schicksal des anderen in diesem wichtigen Markt besiegeln.

Darum war der Tipp den man bekommen hatte eigentlich auch Gold wert. Der Regionalmanager des Unternehmens hatte in Erfahrung bringen können, dass der Kabinettsminister ein besonderes Etablissement geradezu verehrte. In diesem hatten Japaner keinen Zutritt, weil sie seit dem 2. Weltkrieg in Teilen der hiesigen Bevölkerung nicht sonderlich beliebt waren. Aber diese Art des Geschäftemachens war ihm zutiefst zuwider.

Nun war er in seinem Hotelzimmer und in 5 Minuten sollte er für den Termin mit dem Kabinettsminister abgeholt werden. Dabei sollte es natürlich in das bevorzugte Etablissement des Ministers gehen. Der bloße Gedanke daran erregte schon Übelkeit in ihm. Wenn er dabei persönlich nicht erscheinen würde, so erklärte ihm der Regionalmanager sei dies eine Beleidigung und der gesamte thailändische Markt verloren.

Generelle Prinzipien	
	Geschäftserfolg hängt nicht unbedingt von der Frage ab, wer das beste Angebot macht.
	Manchmal muss man von seinen Prinzipien abweichen können.
Spezifische Planhandlungen	
1.	Er sollte überlegen, wie wichtig der thailändische Markt für die Zukunft des Unternehmens ist und dann entscheiden.
2.	Er sollte mit dem Minister mitgehen, aber die Dinge für sich klar ausschließen, die er moralisch nicht vertreten kann.

Langfristige Ziele

Nur mit diesem Geschäft kann das Unternehmen dauerhaft überleben.

Persönliche Prinzipien müssen manchmal hinten anstehen, insbesondere wenn die Arbeitsplätze anderer Menschen davon abhängen.

Bewertung Dritter

Er könnte den Regionalmanager nach Alternativen fragen.

Er könnte einen Freund anrufen, der schon öfter in Asien Geschäfte gemacht hatte.

Situation 2

Ihre Unternehmensgründung war ein voller Erfolg. Nachdem Sie Ihr Studium erfolgreich absolviert hatten, haben Sie direkt den Sprung in die Selbständigkeit gewagt und haben ein Biotechnologieunternehmen gegründet.

Die nachfolgenden Jahre sind eine einzige Erfolgsgeschichte, das Unternehmen kann sich am Markt etablieren und ihre Kenntnisse aus dem Studium haben Ihnen dabei geholfen ein vollkommen neuartiges Insektenschutzmittel auf den Markt zu bringen. Gerade mit diesem Produkt sind sie sehr erfolgreich und generieren einen beachtlichen Umsatz.

Dieses Produkt hat das Interesse eines Waffenherstellers geweckt. Zwar kommunizieren dieses Unternehmen dies nicht so deutlich, aber Ihnen schwant, dass das Interesse vor allem wegen des Patentes und des Know-how in der Herstellung des Insektenschutzmittels herrührt. Der Waffenhersteller bietet Ihnen an, Ihr Unternehmen für einen unglaublich hohen Preis zu übernehmen. Aber was werden die wohl mit dem Wissen Ihres Unternehmens anstellen?

Generelle Prinzipien

Nicht alles ist käuflich.

Jeder Mensch muss für sich entscheiden ob seine Werte zum Verkauf stehen.

Spezifische Planhandlungen

Sie könnten zusätzliche Informationen über den potentiellen Käufer einholen.

Sie könnten nicht verkaufen, um das Wissen zu sichern.

Langfristige Ziele

Sie wollen die Verwendung als Kampfmittel auf jeden Fall verhindern.

Sie können versuchen, immer die Kontrolle über das von Ihnen entwickelte Know-how zu behalten.

Bewertung Dritter

Sie könnten einen Waffenexperten hinzuziehen, der Ihnen Aussagen über die wahrscheinlichste Verwendung Ihres Mittels geben kann.

Sie könnten einen Juristen befragen, inwiefern Sie eine Verwendung als Kampfstoff verhindern könnten.

Situation 3

Das Gespräch mit dem Kunden war anstrengend und wurde hart geführt, aber es schien als ob der erste große Auftrag tatsächlich an Land gezogen werden könne. Alles lief sehr gut und der Geschäftspartner, mit dem sie zusammen das Unternehmen vor kurzem gegründet hatten, machte einen richtig guten Job in den Verhandlungen.

Als ein weiterer Kollege sie aus dem wichtigen Meeting rief, waren Sie zwar etwas irritiert, aber nicht weiter besorgt. Das änderte sich allerdings schlagartig als dieser Ihnen mitteilte, dass ihnen bei der Angebotskalkulation ein grober Fehler unterlaufen sei, den ihr Kollege gerade erst entdeckt hatte: bei dem zunächst kalkulierten Preis würde Ihr Unternehmen sogar noch draufzahlen.

Auf der einen Seite ist Ihr Unternehmen noch sehr jung und kann sich einen solchen Verlust auf keinen Fall leisten. Auf der anderen Seite kann man einem solch wichtigen potentiellen Kunden, nicht vor den Kopf stoßen und seine eigene Unerfahrenheit in solchen Dingen so offen legen. Es musste etwas passieren! Und zwar schnell!

Generelle Prinzipien

Fehler passieren. Man sollte nur verhindern, dass sie sich wiederholen.

Eine genaue Prüfung sollte immer vor der Abgabe eines Angebotes erfolgen.

Spezifische Planhandlungen

Eine genaue Prüfung sollte immer vor der Abgabe eines Angebotes erfolgen.

Sie könnten, bevor sie irgendeinen weiteren Schritt unternehmen, die Berechnung des Kollegen überprüfen. Diesem kann auch ein Fehler unterlaufen sein.

Langfristige Ziele

Auf Dauer müssen bessere Kontrollmechanismen eingerichtet werden, die eine solche Panne in Zukunft verhindern.

Die Bindung dieses Kunden ist langfristig wichtiger als der begrenzte kurzfristige Schaden durch die fehlerhafte Kalkulation.

Bewertung Dritter

Sie könnten versuchen, noch die Meinung ihres Geschäftspartners einzuholen.

Sie könnten den Finanzvorstand fragen, ob das Unternehmen dieses Minusgeschäft verkraften kann.

Situation 4 (based on „The War of Atoms“, pp. 230-234)

So hatten Sie sich das nicht vorgestellt: Das Unternehmen hatten sie selber aufgebaut, jahrzehntelang auf so vieles verzichtet. Jetzt wo sie auf die 70 Jahre zugingen, wollten Sie sich bald zurückziehen, jemandem anderes das Ruder im Unternehmen überlassen und ihr Leben noch ein wenig genießen.

Aber noch mehr als die wirtschaftlichen Probleme Ihres Unternehmens ärgerte sie, dass sich Ihre beiden potentiellen Nachfolger ständig die Schuld für die Krise gegenseitig in die Schuhe schoben, anstatt gemeinsam an einem Strang zu ziehen. Es schien als läge den beiden das Wohlergehen des Unternehmens nicht wirklich am Herzen, sondern sie wollten sich lediglich in eine bessere, bzw. den Konkurrenten in eine schlechtere, Position bringen.

Nach einigen Wochen bemerkten Sie, dass nur einer von den beiden falsch spielte: Aber welcher? So sehr sie auch deren Berichte und Zahlen studierten, es gab keine Hinweise darauf, wer von den beiden auf keinen Fall das Unternehmen bald leiten sollte. Aber es kamen auch nur diese beiden Kandidaten als Nachfolger in Frage, weil sie das Unternehmen und die Kunden in dieser sehr speziellen Branche kannten. Für wen sollten sie sich bloß als Ihren Nachfolger entscheiden?

Generelle Prinzipien

Es darf einem Nachfolger nicht nur ums Geld gehen, er muss auch am Fortbestand des Unternehmens interessiert sein.

Ein Unternehmen lebt von der Qualität der leitenden Angestellten.

Spezifische Planhandlungen

Sie könnten den beiden potentiellen Nachfolgern Aufgaben stellen, die wahrscheinlich weiteren Aufschluss geben können.

Sie könnten bei einzeln zur Rede stellen. Die Reaktion dürfte Ihnen weitere Aufschlüsse geben.

Langfristige Ziele

Sie wollen mit ruhigem Gewissen aus dem Unternehmen gehen und ihren Ruhestand genießen.

Der beste Nachfolger muss gefunden werden, um das Unternehmen in seiner Existenz zu sichern.

Bewertung Dritter

Ihr ehemaliger Stellvertreter, der beide potentiellen Kandidaten damals in das Unternehmen geholt hatte, kann Ihnen vielleicht weiterhelfen.

Sie könnten andere Unternehmensangehörige befragen. Die kennen die beiden besser als sie es als Ihr Chef jemals werden.

Situation 5

Das Gespräch mit dem Sachbearbeiter der Band würde alles entscheiden. Der Businessplan ist geschrieben und er macht wirklich was her. Die Argumente sind überzeugend, eigentlich kann der Mann von der Bank nur zustimmen.

Von allen Seiten hat man Ihnen bestätigt, dass das Gerät, welches sie im Rahmen Ihrer Diplomarbeit entwickelt haben, wirklich etwas Neues darstellt und mit Sicherheit genügend Abnehmer finden wird. Aber zunächst müssen Sie erst einmal das Geld für den Bau des Prototypen haben, denn ohne war kein Kunde von der Machbarkeit zu überzeugen.

Sie selber waren vom Nutzen des Gerätes überzeugt, genau wie ihr betreuender Professor, einem Fachmann auf dem Gebiet. Dennoch waren die Probemessung im Labor nicht eindeutig positiv und hundertprozentig überzeugend gewesen. In einer Stunde sollte das entscheidende Gespräch mit der Bank sein und sie hatten die besagten Laborergebnisse bisher verschwiegen? Sollten Sie dieses potentielle Risiko wirklich nicht ansprechen?

Generelle Prinzipien

Ehrlich währt am längsten.

Wer nichts wagt, der nichts gewinnt.

Spezifische Planhandlungen

Sie könnten mit offenen Karten spielen und versuchen, den Bankier ebenfalls zu überzeugen, schließlich haben Sie das bei anderen ja auch geschafft.

Sie könnten das Gespräch verlegen und neu testen.

Langfristige Ziele

Langfristig ist ein vertrauensvolles Verhältnis mit der Bank überlebensnotwendig für ein junges Unternehmen.

Nur auf vertrauensvoller Basis kann man auf Dauer Geschäfte machen.

Bewertung Dritter

Sie könnten einen Freund anrufen, der bei einer anderen Bank arbeitet, um herauszufinden, wie wichtig dieser Aspekt dem Bankier wohl sein wird.

Sie könnten einen Ihnen bekannten Experten auf dem Gebiet anrufen, um sich zu erkundigen, ob ernsthafte Probleme zu erwarten sind.

XI. SURVEY QUESTIONS FOR ABILITY IN CATEGORY COMBINATION AND REORGANISATION AS WELL AS OPPORTUNITY RECOGNITION

XII. Category Combination and Reorganisation

Grundsätzliche Aufgabenstellung: Bitte widmen Sie sich jetzt den nächsten Aufgaben, deren Grundidee wir Ihnen nun kurz vorstellen möchten:

Diese Aufgabe unterscheidet nun 4 zentrale Konzepte: *Begriffe*, *Kategorien*, *Überkategorien* und *Attribute*.

Kategorien werden durch Begriffe gebildet. So sind z.B. d "Amsel, Drossel, Lerche, Star" alles *Begriffe* der *Kategorie* "Vögel". Anders geschrieben:

Vögel: Amsel; Drossel; Lerche; Star;

Diese *Kategorien* wiederum bilden auf nächster Ebene *Überkategorien*. So gehört bspw. die *Kategorie* "Vögel" zur *Überkategorie* der "Tiere".

Attribute sind schließlich einfache Eigenschaften, die man einem Begriff, einer Kategorie oder einer Überkategorie typischerweise zuspricht. Bspw. würde man der Kategorie der "Vögel" wohl das *Attribut* "kann fliegen" zuordnen. Ein weiteres Bsp. wäre das *Attribut* "klein" für den Begriff der "Lerche".

Jede der 4 folgenden Aufgaben im folgenden Block ist nun wie folgt aufgebaut: Sie sehen drei unbenannte Kategorien, die von 4 Begriffen beschrieben werden. Sie werden daraufhin gebeten, für diese 3 Kategorien:

eine gemeinsame Überkategorie zu benennen,

diese mit einem Satz zu beschreiben,
weitere Begriffe dieser Überkategorie zu benennen, und
weitere Attribute dieser Überkategorie zu benennen.

General Domain

SET 1	**Stuhl** **Couch** **Lampe** **Bilder**	**Reifen** **Sitz** **Lenkrad** **Bremsen**	**Mars** **Jupiter** **Erde** **Venus**

SET 2			
	Protestant	Liter	Objektiv
	Muslim	Esslöffel	Papier
	Baptist	Milligramm	Kamera
	Katholik	Teelöffel	Blitzlicht

SET 3			
	Licht	Handschuh	Reiten
	Hupe	Maske	Laufen
	Bremsen	Springen	Hockeyschläger
	Lenkrad	Fußball	Gewichte

SET 4			
	Kissen	Bootfahren	Skalpell
	Matratze	Segeln	Nadel
	Federn	Tauchen	Klammer
	Leinen	Schwimmen	Gummihandschuh e

Entrepreneurship Domain

SET 1			
	Sparquote	Tresor	Steuern
	Präferenzen	Überweisung	Defizit
	Konsum	Konto	Außenhandelsbilan z
	Einkommen	Schalter	Verschuldung

SET 2			
	Stand	Fernsehen	Verpackung
	Hostess	Radio	Preis
	Halle	Zeitung	Bedienungsanleitu ng

	Werbegeschenke	Plakat	Garantie

SET 3			
	Risikobereitschaft	**Banken**	**Startkapital**
	Stressresistenz	**Freunde**	**Standortwahl**
	Visionen	**Förderungsgesellsc haft**	**Gewerbeanmeldun g**
	Engagement	**Venture Capital-Geber**	**Businessplan**

SET 4			
	Anleihen	**Angebot**	**Hammer**
	Rallye	**Gleichgewicht**	**Bieter**
	Optionen	**Nachfrage**	**Auktionator**
	Aktien	**Tausch**	**Hoechstgebot**

Opportunity Recognition

Generelle Aufgabenstellung: Bitte widmen Sie sich jetzt den nächsten Aufgaben. Sie werden mit 2 wirtschaftlichen Situation konfrontiert. Jede Situation beinhaltet unserer Meinung nach die Gelegenheit, Geld zu verdienen.

Haben Sie eine ungefähre Idee, wie man aus dieser Situation heraus, Geld verdienen könnte? Beschreiben Sie Ihre Idee kurz in etwa 5-7 Zeilen *(verstehen Sie diese Angabe bitte als Mindestwert. Wenn nötig, können Sie natürlich auch mehr schreiben!)* und gehen dabei bitte vor allem auf das von Ihnen erdachte Produkt oder die Dienstleistung und potentielle Kundengruppen ein!

Die organisatorische Umsetzung, wie bspw. die Rechtsform, sollte bei Ihrer Antwort nicht im Vordergrund stehen.

Situation 1

In Ihrem Studium an einer renommierten Universität haben Sie im Rahmen eines interdisziplinären Seminars die Gelegenheit gehabt, engen Kontakt zu einigen Ingenieuren zu knüpfen. Diese haben jetzt für eins Ihrer Projekte, die 3DP™ Technologie, ein Patent erwirken können. 3DP™ steht für dreidimensionales Drucken zur Herstellung von verschiedensten Komponenten.

Diese Technik ermöglicht es Ihnen, eine verformbare Masse, vergleichbar mit einem Puder, in eine Form zu bringen und diese kann dann solange verändert werden, bis ein Bindemittel an den gewünschten Stellen aufgebracht wird. Überschüssiges Pulver kann dann einfach entfernt und wiederverwendet werden. Durch Erhitzen und andere Prozeduren kann die Festigkeit des Materials erhöht werden, so dass das gefertigte Objekt sehr robust und widerstandsfähig ist. Die Ingenieure betonen, dass die Anwendungsmöglichkeiten dieser

Technologie fast unbegrenzt sind: eigentlich kann fast jedes Material in fast jede dreidimensionale Form gebracht werden.

Die Ingenieure selber sind sehr auf die Technologie fixiert und haben sich noch nicht sonderlich viele Gedanken über eine praktische Anwendung der Technologie gemacht. Nun sind sie an Sie herangetreten, schließlich haben Sie im Rahmen Ihres Studiums Veranstaltungen zum Thema "Unternehmensgründung" besucht.

Situation 2

Sie waren bis vor kurzem als Gaststudent an einer ausländischen Hochschule. Weil Sie sich in dem Land wohlgefühlt haben und auch die Sprache inzwischen gut beherrschten, hängten Sie auch noch ein mehrmonatiges Praktikum in diesem Land dran. Hier Erfahrung zu sammeln konnte auch sicherlich nicht schaden, schließlich ist es ein wichtiger Handelspartner Ihres Heimatlandes.

Als Sie wieder in Ihrem Heimatland zurück sind, lassen Sie Ihren Auslandsaufenthalt noch einmal Revue passieren....aufgefallen ist Ihnen insbesondere, dass die Länder unterschiedliche Preisniveaus aufweisen...dies gilt für fast alle Produkte...Konsumgüter, Lebensmittel etc. Zudem sind die Lohnkosten erheblich niedriger, obwohl die Arbeitskräfte eine vergleichbare Qualifikation aufweisen, wie die in Ihrem Heimatland.

Besonders ist Ihnen auch aufgefallen, dass Sie in der kurzen Zeit ein großes Netzwerk an Geschäftsleuten, Unternehmern, usw. aufbauen konnten...anscheinend war das Interesse an Ihnen bzw. der Wirtschaft Ihres Heimatlandes sehr groß.