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Towards a refined understanding of resource gain spirals—
A theoretical discussion of existing research, and novel empirical evidence from two longitudinal intervention studies

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vorgelegt von
Dipl. Wirt.-Inf. Steffani Ungerath
aus Köln

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Diese Dissertation kann wie folgt zitiert werden:

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1   Introduction

In the etiology of psychological disorders, two fundamental questions can be asked: (1) what are the reasons for someone to develop a disorder, and (2) what are the reasons for someone *not* to develop a disorder? Intuitively, both questions seem equally important. It can, however, be argued that the second question is somewhat more relevant, since identifying and preventing the determinants of a disorder would reduce the number of cases in which the first question would have to be asked. Despite this argument, psychology has—for the better part of its existence—devoted itself to answering the first question (e.g., Maddux, 2009).

It may be argued that a shift from the pathogenic tradition to a perspective that focuses on salutogenesis and prevention is *imperative*. It is imperative not only from a humanistic viewpoint, but also from an organizational psychology point of view. To make this argument from an organizational psychology perspective, two major economic pain points will be singled out from among the various challenges facing western societies today.

First, from a *macroeconomic* perspective, many of the countries with a strong social welfare system are currently experiencing a demographic shift towards an ageing population, a trend that places enormous economic pressure on their health care systems. Since 2000, Germany has been spending between 10% and 11% of its gross national product (GNP) on its population's health; each year from 2000 to 2008 the health care cost increased by 2.7% on average (Destatis, 2012a). In 2009—the most recent year for which data is available—the health care cost increment jumped to 5.2%, exceeding the growth of the GNP and amounting to 11.6% of the GNP. With the current demographic trend almost certain to continue, this trend is only likely to increase. In addition to the demographic change, many health care systems are burdened by an increasing prevalence of costly psychological illness-

es. From 2002 to 2008, the cost of mental and behavioral disorders (chapter V of the ICD-10) increased from 10.6% (23.3 bn EUR) to 11.3% (28.7 bn EUR) of the total annual cost of diseases (Destatis, 2012b). Thus it is becoming increasingly important—not only from a humanistic perspective, but also from a macroeconomic point of view—to increase research into and implementation of prevention initiatives.

Second, from a *microeconomic* perspective, companies are increasingly entering a "war for talent" (Michaels, Handfield-Jones, & Axelrod, 2001) in an attempt to attract the most highly-skilled employees from a pool that is continually shrinking due to the demographic shift. Especially in countries such as Germany, with their focus on the research and development of high-tech products and with a high number of knowledge-based professions, a highly qualified workforce is indispensable. As a result, employers cannot afford for their scarce and valuable employees to miss work due to illness—or to be present at work but too ill to be productive. In the year 2010, employees in Germany (excluding pensioners, students, interns and early retires) who were members of the statutory health insurance (GKV) claimed an average of 15.9 sick days each (GBE, 2010). Mental and behavioral disorders (chapter V of the ICD-10) amounted to 8.2% of sick days in 2007 (GBE, 2007), and in 2008 a depressive episode was among the top three illnesses causing most sick days (GBE, 2008). More recent data from BARMER/GEK (2011) health insurance reports that in 2010, psychological and behavioral disorders represented 16.5% of all sick days, and a single case of a psychological or behavioral disorder had an average duration of 41.8 days—which is more than any other illness. It is thus in the employers' best interests to implement preventive measures to support employees' health, taking a sustainable approach to ensuring the well-being and productivity of their employees, rather than pursuing a short-term output maximization.

Hence it can be argued that a salutogenic orientation towards preventing psychological disorders is a necessity from both a macro- and microeconomic perspective. The term "salutogenesis" was originally coined by Antonovsky (1979; 1984; 1996), who investigated reasons why some people do *not* become psychologically ill despite adverse circumstances. Antonovsky found that it is the availability of certain *resources* that prevents individuals from developing psychological disorders. A salutogenic orientation is therefore best grounded in a resource model, as resource models allow for the study of the preventive conditions under which people are optimally protected from psychological suffering. Even today, psychological resource theories continue to be of high relevance in psychology. Their popularity can be ascribed to a number of factors: (1) resource theories allow pursuing a salutogenic perspective; (2) resources and the concepts of losing or gaining resources are of high intuitive value for scientists and laypersons alike; (3) resource theories suggest that the individual situation is dynamic and modifiable, rather than genetically predetermined; (4) the notion of gaining resources is in line with the increasingly popular thinking of positive psychology.

In this thesis, the focus is on Conservation of Resources (COR) theory as one particularly promising representative of psychological resource theories. COR theory is promising for several reasons (cf. chapter 2). First, it is an *integrated* resource theory postulating a variety of relevant resources, which is in line with the notion of clinical psychology that the etiology of diseases is generally not monocausal. Second, COR theory extends Antonosky's thinking to include the idea of a salutogenesis that, once initialized, results into a self-energizing *gain spiral*. Equally, COR theory suggests that resource losses, once initialized, result into self-energizing *loss spirals*. Both of these insights are of high intuitive and practical value: resource gain and loss spirals parallel the prominent concept of a Matthew effect (e.g., Rigney, 2010), which results in the rich getting richer and the poor get-

ting poorer, or respected scientists becoming more highly respected and unknown scientists becoming even less regarded. In addition, COR theory is promising because it has been around for more than twenty years and been frequently cited during this time[1]. Finally, in the American literature, COR theory is considered the leading integrated resource theory (according to Buchwald & Hobfoll, 2004).

In emphasizing the need for a salutogenic perspective, the focus of this thesis is on the theoretical and empirical foundation of resource gain spirals as defined by COR theory. While the notion of gain spirals ("gain begets further gain") is highly intuitive and suggests a number of practical implications, the empirical foundation is still rather small and incomplete. In the over twenty years since the formulation of COR theory, gain spirals have received considerably less attention than loss spirals (Hobfoll, 2011, p. 118). In particular, they have rarely been *empirically* studied. Two reasons for this neglect can be found in the literature (e.g., Hobfoll, 2011): (a) the pathogenic tradition of psychology, which has been discussed above and (b) the empirical finding that loss is generally more salient than gain.

However, while organizational psychology is an applied science, it is also an empirical science that requires the robust empirical embedding of its theories. Thus, in order to validate, elaborate upon, and transfer gain spirals to psychological praxis, a sound empirical foundation is indispensible. Hence, the centerpieces of this thesis are (1) a *literature review* that is intended to inform about the status quo of the empirical research on gain spirals (chapter 3), and (2) novel *empirical research* on gain spirals that aims at closing the existing empirical gaps and advancing the understanding of the mechanisms underlying gain spirals (chapters 5 and 6). Specifically, the literature review evaluates all existing empirical studies on gain spirals, including their contributions and limitations. Guidelines for future research

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[1] As of April 2012, the original article (Hobfoll, 1989b) has been cited by 2,399 publications covered by Google Scholar respectively 1,024 publications covered by the web of knowledge.

are deducted from the major findings of the literature review and developed into a specific research agenda. The research agenda serves two purposes: (a) providing general orientation for any future empirical studies on the topic and (b) providing the specific basis for the empirical studies of gain spirals included in this thesis. Notably, the literature review also confirms the timeliness of the topic: all existing empirical studies took place within the last seven years, and more than 50% in the last three years (2009 to 2011). Finally, a third centerpiece of this thesis is extending the thinking on gain spirals in the direction of possible spillover effects between leisure and work domains (chapter 8).

2   Conservation of Resources (COR) theory

COR theory was first published by Hobfoll in 1989, as an attempt to improve then-existing stress models. Since then, COR theory has developed into one of the most frequently cited resource models (e.g., Buchwald & Hobfoll, 2004). The following chapters are intended to provide an introduction to the underlying theory. Chapter 2.1 explains the basic mechanism of the theory, i.e., defines the four types of resources, and how different impacts on these resources are conceptualized to explain and predict human behavior. Chapter 2.2 clarifies why COR theory can be understood as both a stress theory and a motivational theory. In this context it also touches on Hobfoll's criticism of previous stress models. Before COR theory is put in the context of other resource theories in chapter 2.4, chapter 2.3 introduces the additional postulates of COR theory, including resource gain spirals. Finally, caveats and criticism of the theory are elaborated in chapter 2.5.

2.1   COR theory: Drawing on resources to explain human behavior

The two basic elements of COR theory are (a) resources and (b) operations or impacts on these resource. Taken together, resources and impacts on resources form the basis upon which COR theory explains and predicts human behavior. The following discussion is thus structured into two sections: the first introducing COR theory's conceptualization of resources and the second describing the respective operations or impacts on these resources.

2.1.1   Definition and kinds of resources

The central concept of COR theory is the resource. Examples of resources include "mastery […], self-esteem […], learned resourcefulness […], socioeconomic status […], and employment […]" (Hobfoll, 1989a, p. 516). Hobfoll (1989a) defines re-

sources as the "objects, personal characteristics, conditions, or energies that are valued by the individual or that serve as a means for attainment of these objects, personal characteristics, conditions, or energies" (p. 516). According to this self-referential definition, resources are important to the individual either (1) in a direct or primary sense—because of their very inherent value—or (2) in an indirect or secondary sense—because they may enable to acquire direct/primary resources. As Hobfoll also pointed out (1989a), the four kinds of resources may differ in the degree that they represent direct/primary vs. indirect/secondary purposes. The following elaboration of the four kinds of resources will include this differential aspect.

The first category of resources distinguished by Hobfoll (1989a) describes *objects*. Object resources are mainly direct resources and are valued because of "some aspect of their physical nature or because of their acquiring secondary status value based on their rarity and expense" (Hobfoll, 1989a, p. 517). As an example, a home is an object resource that is valued for providing shelter, while a mansion is an object resource that may be valued for indicating status (Hobfoll, 1989a). Hobfoll (1989a) reasons that although objects have rarely been considered in stress research, they should be included in the resource category because they are linked to socioeconomic status, which in turn has proven to be an important factor in stress resistance.

As a second category of resources, Hobfoll (1989a) speaks of *conditions*. Examples of condition resources are marriage or tenure, in the sense that 'being married to someone' or 'being employed' represent conditions. While conditions appear to be mainly direct resources, valued for their inherent qualities, they may also serve as secondary resources, e.g. when they hedge other resources from being lost. In the latter sense, several empirical research designs have substantiated the stress-mediating effects of conditions, e.g. finding that living with someone resulted in

decreased mortality rates for women with cancer, and that being married is a resistance resource (Hobfoll, 1989a). This notion is also largely supported by the findings of subjective well-being research and hedonic psychology (e.g., Argyle, 1999). However, Hobfoll (1989a) qualifies that "conditions are resources to the extent that they are valued or sought after" (p. 517), which implies that the subjective value of a condition needs to be determined before its actual stress-resistance potential can be deducted. This notion will be elaborated later on.

The third category of resources refers to *personal characteristics*. According to Hobfoll (1989a), these are "resources to the extent that they generally aid stress resistance" (p. 517), which suggests that they are primarily considered indirect resources. Personal characteristics fall into the category of 'general resistance resources' as suggested by Antonovsky (1979; 1996), implying "that one's personal orientation toward the world is the key" (Hobfoll, 1989a, p. 517). In this sense, the personal characteristics resource category takes a differential approach; this is in accordance with various research studies substantiating that certain personality traits and skills offer stress resistance (Hobfoll, 1989a). Examples of mediating personal characteristics are "seeing events as predictable and generally occurring in one's best interest" and "a positive sense of self and a view that one can master or at least see through stressful circumstance" (Hobfoll, 1989a, p. 517).

The fourth and final category of resources consists of *energies*. Examples of energy resources include time, money, and knowledge. These resources are largely considered indirect/secondary resources, which serve the purpose of facilitating the acquisition of other resources (Hobfoll, 1989a). For example, Schönpflug (1985) argues that in the course of goal-directed behavior, individuals draw on energy resources such as money and social credit and evaluate the efficiency of their behavior based on the consumption of these resources (amongst other factors). Others have suggested more specific energy resources, such as social capital, "the

goodwill that is engendered by the fabric of social relations and that can be mobilized to facilitate action" (Adler & Kwon, 2002, p. 17), or cognitive energy, which takes the form of attention span and conscious control (Zohar, Tzischinski, & Epstein, 2003). Regarding cognitive energy, Zohar et al. (2003) contend that it is "finite, unstable, rapidly consumed, and slow to recover, requiring timely replenishment before delay further undermines regulation efficiency" (p. 1085). Equally, other energy resources, such as time, money, and social capital, are characteristically consumed when invested. In contrast, more "structural" (Zohar et al., 2003) energy resources such as knowledge and information are generally retained despite their investment. Overall, energy resources have scarcely been studied (Hobfoll, 1989a).

Quite notably, social support is not included—or intended to fit—in any of the four kinds of resources. Hobfoll (1989a) argued that social support could play both a supporting or a detracting role: "social relations are seen as a resource to the extent that they provide or facilitate the preservation of valued resources, but they also can detract from individual's resources" (p. 517). Nonetheless, only one year later Hobfoll, Freedy, Lane, and Geller (1990) put forward their "Conservation of social resources: social support resource theory," which is intended to extend COR theory by acknowledging the previously underestimated importance of social support. However, the handling of social resources by COR theory remains disputable for two reasons (which will be elaborated upon in chapter 2.5). First, the nature of several claims made in Hobfoll et al.'s (1990) conservation of social resources theory raise some challenges regarding social resources. Second, to date, the successional COR theory-related publications by Hobfoll and colleagues (e.g., Buchwald & Hobfoll, 2004; Freedy & Hobfoll, 1994; Hobfoll, 2001, 2002, 2011) have never *explicitly* integrated social resources into the original COR theory. Rather, they have maintained the original division of resources into objects, conditions,

personal characteristics, and energies—and continued to refer to issues of social support and social resources in an unstructured fashion. Next, it will be elaborated how COR theory draws on the central concept of resources to explain and predict human behavior during stressful and everyday circumstances.

2.1.2   How the model predicts behavior (under stressful *and* everyday events)

One relatively unique aspect of COR theory is that its prediction of human behavior extends beyond purely stressful circumstances to also include predictions of "psychological or behavioral action when people are not confronted with stressors" (Hobfoll, 1989a, p. 517). This broadened scope of interest is in keeping with positive psychology's refusal to focus exclusively on pathology (Seligman & Csikszentmihalyi, 2000).

The four different types of resources identified above can be affected by *four different types of impacts*. Specifically, resources can be (1) lost, (2) replaced, (3) re-appraised, or (4) invested. As will be shown, these four impacts are drawn upon to explain and predict stress, coping, prevention and motivation—i.e., they refer to both stress*ful* and stress *free* circumstances. Figure 2-1 offers a graphic depiction of the four resource categories as well as the four possible impacts (depicted as arrows). Notably, these impacts are either passive/exogenous or active/endogenous. By including active impacts, COR theory relocates people from the space of passively reacting to outside stressors to the space of actively managing and building their resources in order to hedge potential losses (Hobfoll, Lilly, & Jackson, 1992).

The first impact type is exogenous, and is the most prominent impact of COR theory: *resources can be lost*. The actual or potential loss of resources is defined as (psychological) stress, where "both perceived and actual loss or lack of gain are envis-

aged as sufficient for producing stress" (Hobfoll, 1989a, p. 516). The implied assumption that loss is central to *all* psychological stressors will be elaborated in chapter 2.2. Based on this loss-based definition of stress, human behavior is predicted to minimize loss: "when confronted with stress, individuals are predicted by the model to strive to minimize net loss of resources" (Hobfoll, 1989a, p. 517).
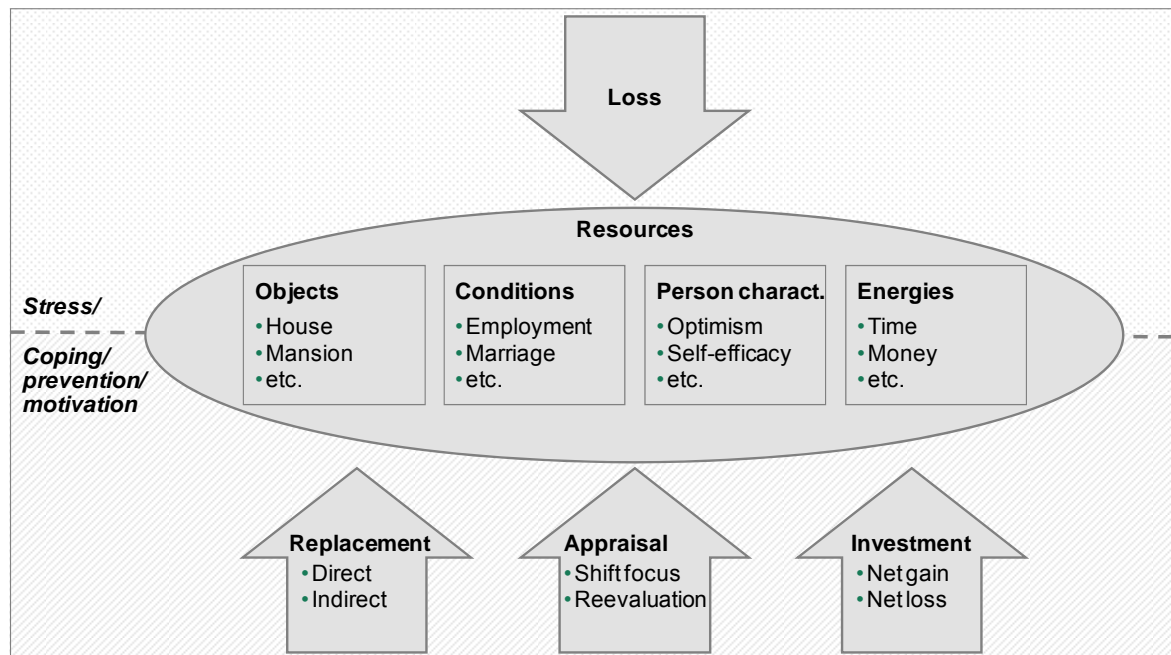
Figure 2-1   Resources and impacts on resources in the COR model

The second impact is endogenous and reveals that *lost resources can be replaced*. A replacement of resources is adopted in order to offset net loss (Hobfoll, 1989a); as such, it can be interpreted as a coping mechanism. Hobfoll (1989a) cites empirical evidence supporting the coping aspect of resource replacement—e.g., findings that "following divorce, […] the most common course is remarriage; […] following miscarriage, women are told by supporters to quickly get pregnant again; […] reemployment following prolonged unemployment largely counteracts loss-related depression, anxiety, and somatization" (p. 518). When a direct replacement of the loss is not possible, a more symbolic or indirect replacement may be an alternative. Any resource replacement, however, is also stressful in itself as it often

depletes the employed resources (Hobfoll, 1989a). While the intention of resource replacement is to offset net loss, it implies the risk that "resources expended in coping outstrip the resultant benefits, [where] the outcome of coping is likely to be negative" (Hobfoll, 1989a, p. 518). Hence, it is important that people realistically judge a resource replacement in terms of potential losses versus gains—a concept which will be elaborated in chapter 2.5.

As a third impact, *resources can be re-appraised*. This endogenous aspect acknowledges that, in addition to objective measures or shared social definitions of loss, subjective perceptions of loss are critical (Hobfoll, 1989a). As such it maintains the tradition of Lazarus' stress theory, which ultimately evolved into an appraisal theory. Hobfoll (1989a) specifies two mechanisms of (re-)appraisal of resources. The first mechanism describes a shift of the focus of attention—e.g., focusing on what one might gain, instead of what one might lose, thus reinterpreting the threat as a challenge. Although this mechanism is unsuitable for tragic stressors, it may be beneficial for everyday stressors such as appraising "the takeover of one's employer by a larger corporation […] as an opportunity for a quick rise in the executive ranks" (Hobfoll, 1989a, p. 519). The second mechanism describes a reevaluation of resources, or more precisely a devaluation of the lost resources (whether potentially or actually lost). As an example, "the stress of school failure can be mitigated by lowering the value placed on education" (Hobfoll, 1989a, p. 519). Both mechanisms can be interpreted as types of prevention or coping behavior, since the re-appraisal allows the individual to prevent or reduce the perceptions of loss. However, Hobfoll (1989a) formulates two caveats to the mechanisms of re-appraisal, which will be discussed in chapter 2.5.

The fourth impact describes how *resources can be invested to gain new resources*; this is an endogenous impact, as well. The fourth impact claims to explain human behavior when individuals are not confronted with stressors; as such, it represents

the motivational aspect of COR theory (see also chapter 2.2). Hobfoll describes two examples of resource investments: individuals may "invest their love and affection to receive a return of the same" or "invest their time and energy […] in attempts to translate them to other more highly prized resources, for example, power and money" (Hobfoll, 1989a, p. 517). However, any investment of resources has two possible outcomes: it may either result in a net gain of resources—the prospect of which is what motivates people to invest resources in the first place—or, if unsuccessful, it may result in a net loss of resources. According to Hobfoll (1989a), a successful outcome results in positive well-being (eustress), while an unsuccessful outcome is sufficient to produce stress, since a lack of resource gain following a resource investment is perceived as loss. However, uncertainties remain regarding the process by which people ponder the anticipated losses and gains of a resource investment (see chapter 2.5). An additional distinction needs to be made between resources that are expended when used (e.g., money, favors) and resources that are put at risk when used (Hobfoll et al., 1990). Sense of mastery is an example of the latter type of resource: it is put at risk when people attempt a difficult task since "if they fail this may detract from their sense of mastery, and if they succeed their sense of mastery may be further enhanced" (Hobfoll et al., 1992, p. 127).

2.1.3   Measuring resources

In order to provide for the measurability of resources—e.g., for the purpose of empirical investigations of COR theory—an evaluation scale has been developed exclusively for this field. The development of the so-called *COR evaluation scale* (COR-E) is documented in Hobfoll et al. (1992). In a group process, parallel groups of diverse members nominated resources that were, in their perspective, important. These lists were shared among the groups and with new groups until no additional resources were nominated that did not overlap with those already on

the lists. The final consolidation of nominated resources comprised 74 resources and has not been altered since. It can be observed that these resources "broadly represent the four resource domains originally defined (i.e., objects, conditions, personal characteristics, and energies)" (Hobfoll et al., 1992, p. 128); however, an explicit allocation of resource items to types of resources has not been performed or not been documented.

Table 2-1   74 resources of the COR evaluation scale (Hobfoll et al., 1992)

Personal transportation (car, truck, etc.)	Adequate food	Adequate credit (financial)
Feeling that I am successful	Home that is more than what I need	Feeling independent
Time for adequate sleep	Stable employment	Financial assets (stocks, property, etc.)
Good marriage	Intimacy with spouse or partner	Knowing where I am going with my life
Adequate clothing	Adequate furnishings for home	Affection from others
Feeling valuable to others	Feeling that I have control over my life	Financial stability
Family stability	Sense of humor	Feeling that my life has meaning or purpose
Intimacy with one or more family members	Role as a leader	Positive feelings about myself
Clothing that is more than what I need	Ability to communicate well	People I can learn from
Sense of pride in myself	Essentials for children	Money for transportation
Free time	Feeling that my life is peaceful	Help with tasks at work
Time for work	Acknowledgement for accomplishment	Medical insurance
Feeling that I am accomplishing my goals	Ability to organize tasks	Involvement with church, synagogue, and so forth
Hope	"Extras" for children	Retirement security (financial)
Good relationship with my children	Sense of commitment	Help with tasks at home
Time with loved ones	Intimacy with at least one friend	Loyalty of friends
Necessary tools for work	Money for "extras"	Help with childcare
Children's health	Self-discipline	Financial help if needed
Stamina/endurance	Understanding from my employer/boss	Health of family/close friends
Necessary appliances for home	Companionship	Involvement in organizations with others who have similar interests
Personal health	Savings of emergency money	
Feeling my future success depends on me	Motivation to get things done	Money for advancement of self-improvement (education, starting a business)
Positively challenging routine	Spouse/partner's health	
Housing that suits my needs	Support from co-workers	Advancement in my education or training
Sense of optimism	Adequate income	
Status/seniority at work	Feeling that I know who I am	

Rating scale and separate evaluation of gains and losses

Hobfoll et al. (1992) initially combined the resources items with a seven-point Likert scale with the extremes of *little loss* or *little gain* (1) and *great loss* or *great gain* (7), where a non-rating (blank) equaled *no loss* or *no gain*. In later publications, Hobfoll (2006; 2007) applied a defined five-point Likert scale: 0 = not at all / not

applicable, 1 = to a small degree, 2 = to a moderate degree, 3 = to a considerable degree, 4 = to a great degree.

Hobfoll (2007) instructs that "in administering the scale, it is critical to assess losses and gains separately; otherwise, respondents average their scores and this obviates application of the theory". There are two major arguments for why preventing subjects from averaging is indeed critical. First, it is important to learn *how exactly events take effect* on the resources. An example by Wells, Hobfoll and Lavin (1999) illustrates this: "For example, a divorce might increase one woman's resources, decrease another woman's resources, and finally, have mixed effects on yet another woman's resources. The COR-E unpacks the gains and losses associated with these different processes" (p. 1175).

Second, several research items show that assessments of losses and gains follow very different rules and cannot be reconciled with the assumption of a fully rational human. Most prominently, cognitive psychologists have theorized and empirically demonstrated that *people generally respond more extremely to losses* than they do to gains, since the displeasure associated with losing is greater than the pleasure associated with winning an equal amount (Tversky & Kahneman, 1981). While Tversky and Kahneman primarily focus on monetary losses and gains, the theory of immune neglect suggests that there is a similar bias towards overestimation of negative events in affective forecasting (Gilbert & Pinel, 1998). Similarly, COR theory proposes that the effect of losses is stronger and more enduring than the effect of gains (Hobfoll, 1989b, 2001); this notion corresponds with the COR's principle of the *primacy of loss* and will be elaborated in chapter 2.3.1. Hence assuming that losses and gains follow very different evaluation rules and are weighted differently, adding them together would produce a false result and hide underlying effects.

Evaluation of the COR-E

Hobfoll et al. (1992) performed an initial evaluation of the COR-E, primarily investigating the scale's reliability and construct validity. The evaluation was based on data obtained from two samples—a community sample and a college sample combining 329 subjects. The samples were measured twice, at an interval of two weeks. Each time, subjects were asked to rate both recent resource losses and gains and resources losses and gains during the past year.

The *test-retest reliability* was expected—and confirmed—to be at moderately high levels: recent losses and gains correlated at .55 and .64, respectively, and the past year's losses and gains correlated at .64 and .76, respectively. The authors argued that neither a low nor a high test-retest reliability would have been desirable. Low test-retest reliability would indicate that the scale would be measuring *mood*, while high test-retest reliability would be an indicator for measuring *trait*-like representation of resources.

The test for the *construct validity* investigated whether individuals report particular losses and gains experiences in the COR-E (desired) instead of merely a general sense of loss and gain (undesired). The analyses support the claim that the COR-E measures particular losses and gains: exploratory principal analysis could not find a global factor, but revealed several discrete and distinguishable factors. In addition, the factors identified in the community sample differed from the factors in the college sample, which supports the existence of developmental differences. For example, the community sample shows more losses related to family and marriage, while the college sample exhibits more losses concerned with identity (Hobfoll et al., 1992).

2.2 Understanding COR theory as stress and motivation theory

COR theory was originally developed with the intention of advancing traditional thinking on stress. Hobfoll (1989a) even subtitled his first publication on COR "a new attempt at conceptualizing stress". Claiming that most of the stress models existing at that time were tautological, Hobfoll (1989a) argued that the COR model "is more directly testable, comprehensive, and parsimonious than previous approaches and that it provides a clearer direction for future research on stress and stress resistance" (p. 513). The basis for this proposition will be explored in this chapter, based on a review of the most prominent traditional stress models. COR theory is *comprehensive* foremost because it also embraces a motivational theory and predicts behavior beyond stressful situations. Thus, this chapter will continue to discuss the motivational conclusions of COR theory. Moreover, COR theory understood as a stress theory and as a motivation theory will be conceptualized as two sides of the same coin. The basic tenets of motivation cannot be understood without understanding stress; for this reason it is essential to consider both of these aspects in this chapter—despite the fact that this thesis pursues a specific focus on motivation and well-being rather than on stress.

2.2.1 COR theory as a stress theory

COR theory defines stress as "a reaction to the environment in which there is (a) a threat of a net loss of resources, (b) the net loss of resources, or (c) a lack of resource gain following the investment of resources" (Hobfoll, 1989a, p. 516). Three aspects of this definition are noteworthy. First, stress can be caused not only by actual stress (part (b) of the definition), but also by anticipated or feared stress (part (a)). Second, stress is not necessarily caused externally, but may be caused by the very person who is experiencing it if he or she is unsuccessfully investing resources, according to part (c) of the definition. Third and most notably, Hobfoll

(1989a) claims that net loss or lack of gain is not only a sufficient condition to explaining stress, but also a necessary condition. This implies that "loss would have to be central to all psychological stressors" (Hobfoll, 1989a, p. 518). In other words, according to Hobfoll (1989a), stress exclusively takes the form of a resource loss, and any event which cannot be interpreted as a resource loss—such as a change, transition, or challenge—is not in itself stressful. The implications of this assumption will be discussed in chapter 2.5.

When Hobfoll (1989b) originally developed COR theory he criticized most of the stress theories existing at the time. A brief overview of Hobfoll's (1989b) criticism of these theories should help to understand the legitimacy and novelty of COR theory as a stress theory. One view of stress at the time was the *response perspective* propagated by Cannon (1932) and Selye (1950), who understand stress as an orchestrated defense reaction of the physiological system to environmental challenges (Hobfoll, 1989b). There are essentially three critiques of this view, all of which have been addressed by COR theory. First, the response view suggests that people respond uniformly to stressors, all following a common reaction. However, "how people respond to challenges from their environment can be seen as a function of their personality, constitution, perceptions, and the context in which the stressor occurs" (Hobfoll, 1989b, p. 513). Hence, COR theory understands stress and the stress reaction as relative to the level and nature of the individual's resources at a given point in time. Consequently, COR theory allows for different types of resistance reactions: individuals may chose between replacing or reevaluating lost resources, shifting the focus away from lost resources, or investing other resources to regain lost resources (as outlined in the preceding chapter). Second, defining stress exclusively based on the stress response implies that stressors can only be identified retrospectively, i.e., only after the stress response has occurred (Hobfoll, 1989b). COR theory, on the other hand, defines stress based on both ac-

tual and *anticipated* loss, allowing for an anterior identification of stressors. Third, the response view is limited to a physiological operationalization of stress (Hobfoll, 1989b). COR theory, as well as most other stress theories, incorporates both physiological and psychological views of stress; in fact, most modern stressors are of a psychological, rather than physiological, nature.

A second view of stress popular at the time, also an environmental perspective, sought to identify normative stressors, i.e., the stimulus causing stress. The basic idea was to develop and categorize a finite list of events generally known for causing stress (B. S. Dohrenwend, Krasnoff, Askenasy, & Dohrenwend, 1978; Elliot & Eisdorfer, 1982; Holmes & Rahe, 1976; Kanner, Coyne, Schaefer, & Lazarus, 1981). This approach is still current, especially in the domain of clinical psychology (e.g., B. P. Dohrenwend, 2006). Generally, Hobfoll (1989b) agrees with the existence of normative stressors and acknowledges the importance of creating a taxonomy of these, since (1) it "limits the world of events that one would otherwise have to observe […] in order to study the stress process" and (2) it provides "the division between [normal] stress responding and neurotic symptoms" (p. 514). Nevertheless he points out that the stimulus-view represents only one aspect of the stress phenomenon (Hobfoll, 1989b). In some respects, the stimulus perspective and COR theory can be considered complementary. While the stimulus perspective does not look beyond the stressors, COR theory entirely disregards the nature of the stressor (understanding a stressor as any event that potentially causes loss) and focuses on the processes following the identification of a potential resource loss.

A third view of stress adopts a more cognitive approach, integrating the role of appraisal and the perspective of homeostasis. Lazarus and Folk man (1984b) proposed that stress results from an *imbalance* between the demands of the environment and the resources or coping capabilities of an individual. Specifically, they emphasize that this imbalance results from the individual's *appraisal* of demands

and capabilities. Hobfoll's (1989b) criticism here is threefold, discarding the "balance model" for being "tautological, overly complex, and not given to rejection" (p. 515). The first critique, tautology, is grounded in a circular definition of demand and coping capacity: "demand is that which is offset by coping capacity. Yet, coping capacity is that which offsets threat or demand" (Hobfoll, 1989b, p. 514)—which in addition is only based in perceptions. Hence, Hobfoll (1989b) calls for an anchoring point that would make these demands and coping capacities tangible; in COR theory, he provides such an anchor by offering the concept of resources. In the second critique, Hobfoll (1989b) points out that Lazarus and Folkman's (1984b) balance model requires two units for understanding stress, i.e., demands and coping capabilities. COR theory, in contrast, considerably reduces complexity by requiring only a *single* unit to understand stress, i.e. resources. Third, Hobfoll (1989b) claims that it remains unclear how to measure the two concepts of demands and coping capabilities, and as a result the model withdraws itself from the opportunity of testing and hence from rejection. COR theory, on the other hand, offers the COR evaluation scale as a meaningful measure of resources and has supported several empirical studies testing the theory's propositions (Hobfoll et al., 1992). In addition to these three items of critique, Hobfoll (1989b) disagrees with the exclusively subjective definition of stress, as a result of which there is no stress without the perception of it. Instead he suggests a definition that acknowledges both objective and subjective stress. In a later publication, Hobfoll (2001) specifically refers to Kaplan's (1983) definition of stress as the internal state that:

> "reflects the subject's inability to forestall or diminish perception, recall, anticipation, or imagination of disvalued circumstances, those that in reality or fantasy signify great and/or increased distance from desired (valued) experiential states, and consequently, evoke a need to approximate the valued states" (p. 196; cited after Hobfoll, 2001).

This definition unites subjectivity and objectivity in that "the perceptions that are referred to are primarily reality-based and socially common within a culture, even

if there is also an important additional individual component to such perceptions" (Hobfoll, 2001, p. 339). Finally, it can be observed that the balance model is limited to the explanation of behavior in stressful situations and does not offer insights into behavior in stress-*free* situations. The balance model does not propose a satisfying rationale for why people should try to achieve more coping capabilities than are required to balance their demands. COR theory, on the other hand, also embraces a motivational theory and as such predicts behavior even in non-stressful circumstances (as will be elaborated later in this chapter).

A fourth view represents a three-part approach that integrates the environmental stimulus perspective, the cognitive appraisal perspective, and a differential perspective (Hobfoll, 1989b). Specifically, the role of an individual's characteristics, such as his or her response disposition, is considered to interact with the particular stimulus and hence to influence the nature and intensity of the individual's response (e.g., Spielberger, 1966). This thinking has been particularly fruitful in research on text anxiety (e.g., by Sarason, 1972). Notably, this fourth view is the approach that Hobfoll (1989b) most agrees with. He emphasizes two advantages of the perspective: First, "it illustrates both that certain events are commonly viewed as stressful and that individuals differ in their degree of reactivity to normatively stressful events" (p. 515). Second, it combines the environmental, appraisal, and personality views in a very balanced fashion and without overemphasizing one single view, a circumstance that Hobfoll (1989b) calls "a conceptual leap for stress researchers" (p. 515). Hence, COR theory reveals a very similar understanding of the stress mechanisms, offering some room for the influence of individual appraisal, but simultaneously stressing the role of normative stressors. The third aspect, personality, is included in the resources offered by the COR evaluation scale. Hence, the individually perceived stress of a normative stressor is impacted by the availability of personal resources such as, e.g., 'optimism'. Finally, Spielberger's

(1966) definition of stressful events can be reconciled with COR theory's definition of stress as the actual or perceived loss of resources. He suggests that events are stressful if they are perceived as threats to either the physical self (physical threats) or the phenomenological self (ego-threats). Adding to Spielberger's (1966) definition the assumptions that (1) threats are caused foremost by losses and (2) the phenomenological self encompasses all resources that are valued by the individual, i.e., including material resources, energy resources, and social resources, then this definition is congruent with COR theory.

In summary, it has been shown how COR theory draws on the limitations of the response view, the stimulus view, and the balance model to propose an enhanced stress model. By focusing on resources as the single unit required to understand stress, it is more parsimonious than the discussed approaches. By additionally offering the COR evaluation scale as a means of measuring these resources, it is as well testable and avoids being tautological. By embracing both subjective and objective stress, and by following the three-part approach that balances the impact of stressor, appraisal, and personality, COR theory also bridges across the gap between environmental and cognitive perspectives (Hobfoll, 1989b). Finally, by furthermore predicting behavior in stress free situations, it proves more comprehensive than prior approaches. This latter quality of COR theory will be discussed in the following paragraphs.

2.2.2   COR theory as a motivational theory

Notably, COR theory does not only conceptualize stress, but "is both a stress and motivational theory" (Westman, Hobfoll, Chen, Davidson, & Laski, 2004, p. 167). It also constitutes a motivational theory, since its basic tenet states that "people strive to retain, protect, and build resources" (Hobfoll, 1989a, p. 516). There are two mo-

tivational aspects: first, individuals seek to gain resources, and second, individuals seek to protect them from loss.

The first aspect explains individuals' behavior under stressful circumstances; that is, individuals are predicted to protect their resources from loss in order to avoid feelings of stress. When individuals cannot entirely prevent resource loss, they attempt to minimize the loss. As discussed in the preceding chapter, this is achieved by either a resource replacement or a resource reappraisal. Both strategies, however, have the following limitations: (1) resource replacement involves a resource investment and, as such, must result in a net gain in order to be successful, while (2) resource reappraisal is not beneficial if it concerns resources which are basic to an individual's sense of self (Hobfoll, 1989a).

The second aspect explains individuals' behavior when they are not confronted with stress; as such, it is a relative novelty within what was labeled as a stress theory. Specifically, people are thought to "strive to develop resource surpluses in order to offset the possibility of future loss" (Hobfoll, 1989a, p. 517). In order to achieve resource surpluses, people are predicted to actively invest their resources with the intention of earning a 'return on investment'. An example:

> "Investment in resources may be observed in good marriages. In such marriages, both partners are constantly contributing from what they have to each other and to the relationship. There is a long-term expectation, however, that their investment will produce a payoff in terms of returned love, esteem, affection, and security" (Hobfoll, 1989b, p. 520).

In addition to sheltering people from future stressors, resource surpluses have a second function. Resource surpluses result in eustress, i.e., psychological well-being: "surplus of resources is a desired condition; it may act in ways that […] beget eustress, a sense of control and positive association with the environment" (Hobfoll, 1988, p. 43). This view is shared by positive psychology and current well-being research, which has sought to establish to what extent different resources

contribute to psychological well-being (Diener & Fujita, 1995). It needs to be remembered, however, that the motivation to protect resources from loss is stronger than the motivation to create resources surpluses for the sake of well-being (Hobfoll, 1998a).

Based on these two aspects, COR theory can be classified among the hedonic theories of motivation (Reisenzein, 2001). Hedonic theories have been described to (1) postulate a universal egoism according to which all human behavior is motivated by self-interest, which (2) may take the form of a universal hedonism. The latter infers that the postulated self-interest consists of an optimized hedonic balance: it assumes that people are foremost motivated to remedy or prevent negative feelings and to retain or induce positive feelings (Reisenzein, 2001). According to Reisenzein (2001), prominent theories that fall into this class of hedonistic motivation theories are, e.g., dissonance theory (Festinger, 1957), self-discrepancy theory (Higgins, 1987), and equity theory (Walster, Berscheid, & Walster, 1973). Furthermore Freud's (1930) pleasure principle, Maslow's (1943) hierarchy of needs and Bandura's (1977) social learning theory are associated with this category of theories. Hobfoll (1989b) explicitly places COR theory in the tradition of Freud, Maslow, and Bandura, and COR theory indeed fulfills the definition of a hedonic motivation theory. Universal hedonism is the basic motivation in COR theory, since resources are gained (a) for the sake of positive feelings of eustress created by resource surpluses and (b) in order to hedge resources losses, which would otherwise elicit the aversive feeling of stress.

Notably, though, COR theory does not specify whether there is a homeostatic maximum for resource gains or whether individuals are motivated to gain resources indefinitely. Nor does it, on a resource level, distinguish between resources that follow a deficiency motivation and resources that follow a growth motivation—a meaningful differentiation offered by Maslow (1954). However,

Hobfoll (1989b) predicts that people behave like good financial investors, who "invest greater resources for greater payoff or for increased odds of payoff (i.e., low risk)" (p. 520). This would imply a mere growth motivation and hence an infinite process of resources maximization—only limited by the number of available investment opportunities that guarantee greater return than investment. Whether it is indeed reasonable to assume growth motivation for all resources, or whether at least a subset of resources rather adheres to a deficiency motivation, will be discussed in chapter 2.5.

Nevertheless, COR theory proposes a parsimonious, comprehensive, and testable motivation theory. On the down side, no substantial empirical research on COR theory as a motivation theory is known; COR theory as a stress theory, however, has widely been tested (e.g., an overview of studies in the domain of organizational stress is provided by Westman et al., 2004). Also, the notion that people in stress-free situations indefinitely invest their resources to create resource surpluses clashes with the findings on leisure time behavior that will be discussed in chapter 8.2. As will be shown, people experience less positive affect in their leisure time than in their working hours. In fact, most people spend their free time watching TV rather than pursuing active leisure time activities that would increase their resources (e.g., physical activity could elicit gains in physical fitness, sense of mastery, and knowledge). Since leisure time behavior is self-determined, this raises the question of why people do not chose to spend their time on resource-generating activities, as COR theory would predict.

To summarize this chapter, stress and motivation in COR theory may be interpreted as two sides of the same coin. On the one side of the coin, there is stress, which is caused by the actual or anticipated net loss of resources. Stress is mostly caused by external events, but may also be self-caused through unsuccessful resource investments. On the other side of the coin, there is the motivation to protect and gain

resources. The existence of this motivation, however, is interdependent with the general existence of stress: it serves the purpose of replenishing resource levels after stressful events respectively creating a resource buffer for future stressful events. Stress in turn can also be viewed as interdependent with motivation. The fundamental assumption that resource loss creates stress can be explained on the basis that possessing resources creates psychological well-being, and losing resources reduces well-being. Consequently, stress and motivation in COR theory—as the two sides of the coin—are both centered on peoples' resources, share the common goal to maximize resource levels, and are to some extent interdependent. The latter circumstance is underlined by the postulate that resource gains are weighted higher in the light of resource loss (Hobfoll, 2001), which—inter alia—will be elaborated in the following chapter.

2.3   Further COR postulates

The mind map depicted in Figure 2-2 summarizes the major postulates of COR theory. The first three groups of postulates, namely the definitions of stress and motivation, the four kinds of resources, and the predictions of behavior, have already been discussed in the preceding chapters. A fourth group comprises three further principles of COR theory: (1) the primacy of loss, (2) loss and gain spirals, and (3) resource caravans. These will be elaborated in the current chapter.
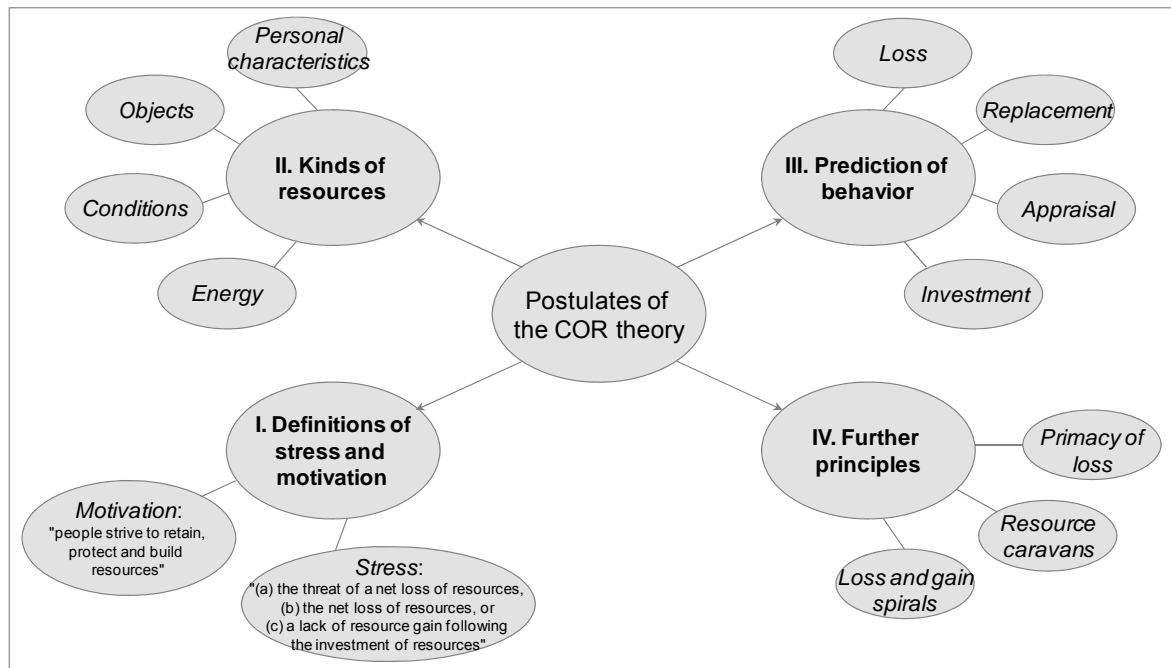
Figure 2-2   Major postulates of COR theory

2.3.1   The primacy of loss

The first advancing principle of the COR theory, the primacy of loss, is defined via two constituting qualities: (a) "given equal amounts of loss and gain, loss will have significantly greater impact" and (b) "resource gains are seen as acquiring their saliency in light of loss; that is, in the context of resource loss, resource gains become more important" (Hobfoll, 2001, p. 343). This notion is in line with several theories and with empirical research from several domains within psychology, suggesting that assessments of losses and gains follow very different rules. Particularly relevant here are the conclusions of prospect theory, which postulates that when evaluating potential (monetary) losses and gains of equal size, people ascribe more weight to losses than to gains. Thus, negative utility curves are steeper than positive utility curves (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). While prospect theory primarily focuses on monetary losses and gains, the theory of immune neglect finds a similar bias towards overestimation of negative events in the context of affective forecasting (Gilbert & Pinel, 1998). Negativity

bias theory likewise suggests that negative information influences evaluations more strongly than comparably extreme positive information (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001; Rozin & Royzman, 2001; Tiffany, Larsen, Smith, & Cacioppo, 1998).

Hobfoll (2001) reasons that a possible (although unprovable) explanation for the primacy of loss may be found in evolutionism. His reasoning is that biological, attentional, psychological, and cultural systems find it adaptive to place more emphasis on losses than on gains, since losses potentially threaten an individual's existence and hence require immediate attention and response (Carver & Scheier, 1998; Hobfoll, 2001).

First empirical studies related to COR theory support primacy of loss. Taylor (1991) finds evidence indicating that "negative events evoke strong and rapid physiological, cognitive, emotional and social responses" (p. 67), and that these responses are greater for negative than for neutral or positive events. Hence there seems to be an asymmetry in the effects of positive and negative events. Similarly, Suh, Diener, and Fujita (1996) find that recent negative life events are better predictors of both positive and negative affect than are recent positive life events. In two studies, one with a student sample and one with a community sample, Hobfoll and Lilly (1993) find that recent resource losses were significantly related to psychological distress, while resource gains were in no case significantly related to psychological distress.

Hobfoll and Lilly (1993) have additionally investigated the second quality of primacy of loss, namely that resource gains are more important in the context of resource loss. Similarly, Ennis, Hobfoll, and Schroeder (2000) study the buffering effects of resource gains for single and low-income inner-city women. They largely confirm their hypothesis that resource gains, such as mastery and social support,

are "more beneficial in offsetting the negative consequences of acute resource loss than chronic economic lack because acute loss is more likely to create identifiable demands against which resources can be mobilized" (Ennis et al., 2000, p. 155). In two studies, Wells, Hobfoll, and Lavin (1997; 1999) examine the effects of resource gains on pregnant women's experiences of resource losses. Typical resource losses include "physical changes and discomfort, concerns about the health of the unborn child, worries about raising the child, and fears and anxiety about the birth process itself" (Wells et al., 1999, p. 1174). They find that resource gains were most salient when resource losses co-occurred, i.e., when they could buffer the negative impact of resource losses.

Resource loss has also repeatedly been studied in the context of (a) traumatic events such as natural disasters and (b) burnout. Disaster studies of hurricanes and earthquakes generally find resource loss to be predictive of post-traumatic stress-disorders, general psychological distress, and mobilization of coping strategies (Hobfoll, 2001). While losses associated with *natural disasters* can be described as sudden, unexpected, and occurring to their full extent at one certain point in time, losses associated with *burnout* are characterized by gradually increasing stress caused by a sequence of minor losses. Hence, burnout studies have investigated the effects of chronic, minor losses on both self-reported burnout symptoms (Lee & Ashforth, 1996) and medical outcome data (Siegrist, 1996). For example, Lee and Ashforth (1996) identify several aspects of the working environment which contribute to resource losses or resource gains. They find that only one gain correlate was related to lower burnout, but five out of eight loss correlates were strongly related to greater burnout (Hobfoll, 2001; Lee & Ashforth, 1996).

2.3.2   Resource caravans

COR theory states that resources generally exist in caravans, i.e., the existence of one resource is a strong predictor for the existence of other resources, while the absence of one resource increases the probability that other resources are also absent. Hobfoll (2001) provides the example that "having a sense of self-efficacy is likely to be linked with optimism and the availability of social support" (p. 350), while the opposite is true for low self-efficacy. This concept implies that resources cannot be considered independent from one another, but rather are related through a protective influence (Hobfoll, 2001).

Additionally, COR theory suggests that this concept of resource caravans applies both in the immediate term, as in the example above, and over the course of the life-span. This implies that strong resource levels at one point in time are a strong predictor for high resource levels in the future, while resource lack at one point makes resource lack in the future more likely. Hence, there tends to be a continuity of resources over the life span: "consistent with a caravan concept, the retinue of resources tends to travel together over time" (Hobfoll, 2001, p. 350).

Basic empirical support for resource caravans is proposed by Rini, Dunkel-Schetter, Wadhwa, and Sandman (1999), who find in their prospective study that women with stronger personal resources had higher birth weight babies. Likewise, Cozzarelli (1993) establishes that personal resources predict ability to cope with abortion in women. Beyond that, Hobfoll (2011) suggests how the concept of resource caravans can be applied in organizational settings in order to increase employee engagement.

2.3.3   Loss and gain spirals

COR theory not only thinks of resources as occurring in caravans, but also proposes the development of cycles or spirals for both resource losses and gains. According to the concept of loss spirals, individuals who experience a loss of resources will experience a further loss of resources, and in an increasing fashion. At each lower level of resources they are in an even weaker position to protect the remaining resources and to offset additional losses (Hobfoll, 1989b, 2001). Gain spirals work accordingly: individuals who experience resource gains will be in a better position to gain even more resources and hence are likely to experience increasing levels of resource gains. The supporting rationale is that with greater resources it is easier to offset resource loss and to orchestrate additional resource gains (Hobfoll, 2001).

By definition, loss spirals and gain spirals constitute "amplifying loops in which cyclic relationships among constructs build on each other positively over time" (Salanova, Schaufeli, Xanthopoulou, & Bakker, 2010, p. 119). These spirals have to meet two conditions. First, they have to represent a reciprocal relationship, defined as the coexistence of normal *and* reversed causation between different resources. Second, absolute levels of the respective resources have to decrease (in case of loss spirals) respectively increase (in case of gain spirals) over time (Salanova et al., 2010). Notably, for a relationship to be reciprocal it is also necessary that the two causal relations are not independent —i.e., "only when the size of influence in one direction has an effect upon the size of the influence in the other direction and is in turn affected by it, is there a mutual causation" (Maruyama, 1963, p. 175).

Both loss and gain spirals thus create positive—i.e., self-reinforcing—feedback loops. This supports the concept of deviation-amplifying mutual causal processes.

This concept stems from cybernetics—the science of self-regulating and equilibrating systems—and finds supportive evidence in a vast range of domains, such as "accumulation of capital in industry, evolution of living organisms, the rise of cultures of various types, interpersonal processes which produce mental illness, international conflicts […]" (Maruyama, 1963, p. 164). It seems only natural to apply the idea of amplifying deviations to resources of individuals, as suggested by Maruyama in 1963: "mutual amplification may occur within a person, for example, between loss of self-confidence and poor performance in a neurotic person" (p. 178). Based on this work by Maruyama (1963), Aldwin, Sutton, and Lachman (1996) developed the deviation amplification model of stress and coping, suggesting that coping is a process which has the potential to change coping resources such as management skills, which in turn also affect personal resources such as mastery and self-esteem. Although this model is reduced to the aspects of mastery and coping, it is clearly in the same line of thought as COR theory's loss and gain spirals. Hence its conceptual model, depicted in Figure 2-3, may serve as an exemplary illustration of a loss respectively gain spiral.
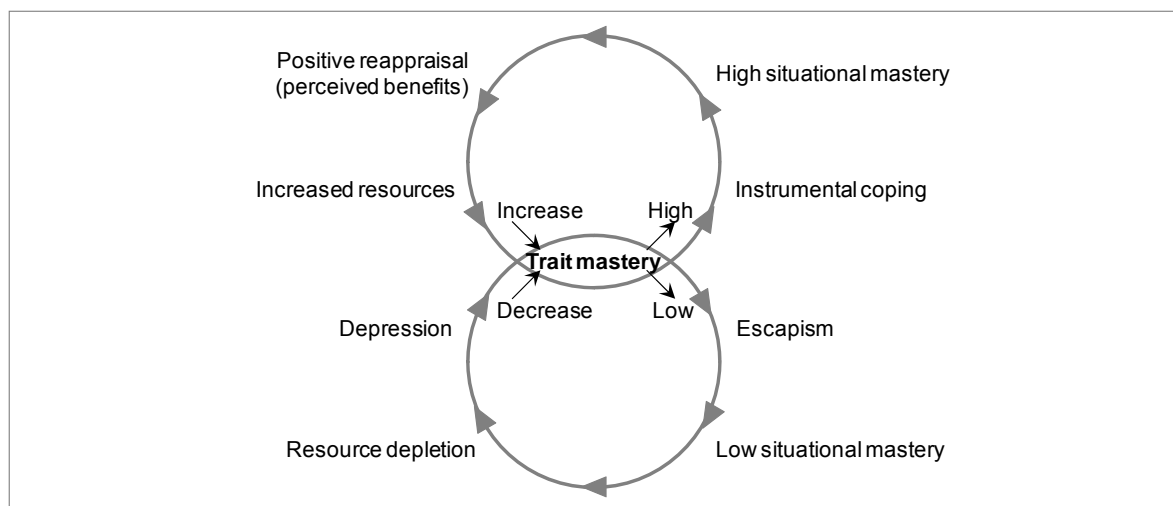
Figure 2-3   Loss and gain spiral as conceptualized in the deviation amplification model (cf. Aldwin et al., 1996)

Although the notion of *loss spirals* is appealing and intuitive, there has been little *empirical* testing to support it (ten Brummelhuis, ter Hoeven, Bakker, & Peper, 2011). This may be attributed to the fact that testing reciprocal causal relationships is challenging in terms of research design and raises many methodological issues (Zapf, Dormann, & Frese, 1996). Early empirical research on loss spirals established, e.g., that resource loss in patients with a severe chronic breathing disorder increased patients' anger and in turn their supporters' anger (C. Lane & Hobfoll, 1992), which made them increasingly vulnerable to additional resource loss in an expanding cycle (Hobfoll, 2001). Similarly, Wells et al. (1997; 1999) find that resource losses have an accelerating effect on further resource losses in middle-aged pregnant women. More recent empirical research on loss spirals has been largely implemented in an organizational context, establishing loss spirals, e.g., in the context of burnout (Diestel & Schmidt, 2010; ten Brummelhuis et al., 2011), between work characteristics, work-home-interface, and employee well-being (Demerouti, Bakker, & Bulters, 2004), and between job demands, work-family conflict, and emotional exhaustion (Hall, Dollard, Tuckey, Winefield, & Thompson, 2010). On the other hand, Schaufeli, Bakker, and Van Rhenen (2009) did not find support for their hypothesis that a reciprocal relationship exists between resource loss and burnout.

The empirical research on *gain spirals* will be covered extensively in a separate chapter (see chapter 3). Generally, though, it can be observed that gain spirals have received considerably less attention than loss spirals (Hobfoll, 2011). Two major reasons for this circumstance can be identified: first, psychologists have traditionally focused on deviancy and psychopathology (Hobfoll, 2011). Instead of studying the foundations of positive gain processes, they have been interested in the preconditions of loss processes that entail psychopathology. Second, there is a qualitative distinction between loss and gain spirals that makes the former easier

to study. Specifically, gain spirals are expected to have less momentum, lower magnitude, and a shorter half-life than loss spirals and are generally less meaningful to individuals than loss spirals (Hobfoll, 1998; Hobfoll & Lilly, 1993). This expectation essentially represents the application of the primacy of loss principle to loss and gain spirals: losses are more salient than gains, while gains are less relevant per se than in the context of loss. As a result, the smaller effect of gain processes is more difficult to substantiate.

Nonetheless, gain spirals are increasingly coming into focus. One major reason for this is the emergence of positive psychology, from which has developed, for example, the *broaden-and-build theory* of positive emotions (Fredrickson, 2001). The broaden-and-build theory is supportive of gain spirals and proposes that positive emotions have the potential to initiate upward spirals towards increasing emotional well-being (Cohn & Fredrickson, 2009; Fredrickson & Joiner, 2002); see Figure 2-4 for an illustration of this process. Although these upward spirals specifically refer to positive emotions, they are clearly similar to COR theory's concept of gain spirals. Especially so as Fredrickson and Joiner (2002) also ascribe an important role to resources, acknowledging that "a key, incidental outcome of these broad mind-sets [which are induced by positive emotions] is an increase in personal resources: As individuals discover new ideas and actions, they build their physical, intellectual, social, and psychological resources" (p. 172). A much older theory from the field of sociology which also postulates a mechanism similar to gain spirals is the *Matthew effect*, a term coined by Merton (1968). The Matthew effect refers to a line in the New Testament (Matthew 25:29): "For unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath". The Matthew effect is also known as cumulative advantage processes; the processes it describes are a direct equivalent of COR theory's gains respectively loss spirals. The Matthew effect has been pri-

marily investigated in the contexts of education (e.g., Stanovich, 1986) and science (Merton, 1968, 1988).

produces more experiences of positive emotions, creating an upward spiral

Enhanced health, survival, fulfillment

Building enduring personal resources (e.g., social support, resilience, skills and knowledge)

Novel thoughts, activities, relationships

broadening
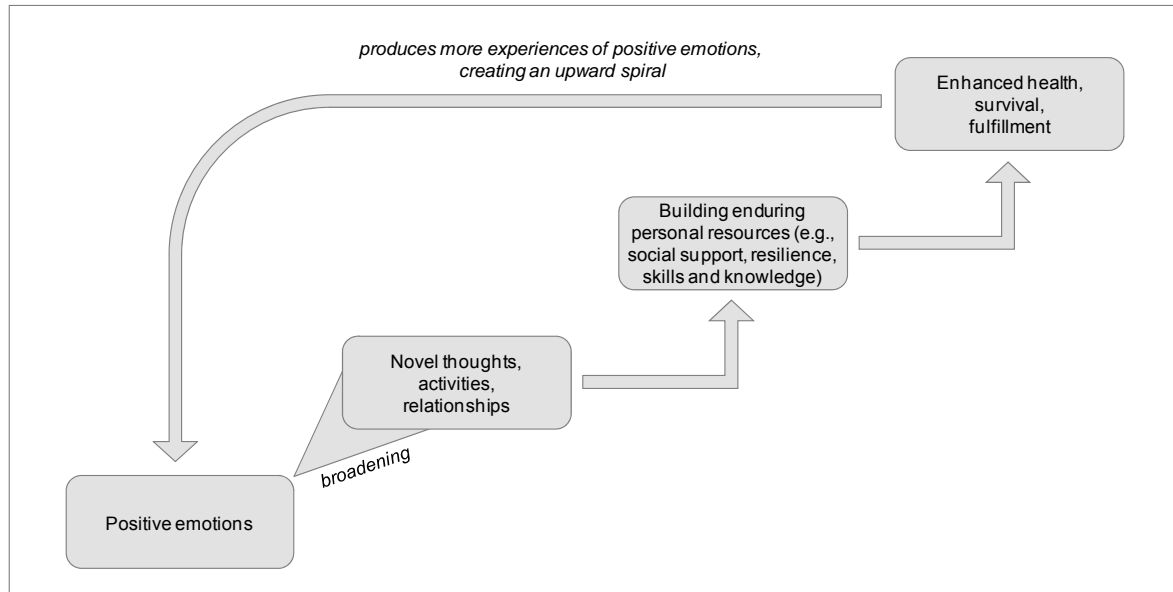
Positive emotions

Figure 2-4   Upward spiral of positive emotions (Cohn & Fredrickson, 2009, p. 16)

There is a disparity between the increasing theoretical support for gain spirals and the continued lack of empirical support (cf. chapter 3). One major goal of this thesis is to contribute to reducing this gap by providing further empirical evidence. Simultaneously, this paper addresses a shortcoming of COR theory in the context of loss and gain spirals, namely, that COR theory does not theorize on the gradients of the spirals. COR theory does not discuss whether gain spirals (and analogously, loss spirals) over time are expected to (a) take a linear curve of constant growth, (b) increase in momentum to take an exponential curve of increasing growth, or (c) slow down to take an asymptotical curve of decreasing growth. Furthermore, gain spirals might even (d) lead to a point of reversal, forming a U-curve which would represent the idea of having 'too much of a good thing'.

2.4 COR and other resource theories

Hobfoll (2002) provides a comprehensive review of psychological resource theories, distinguishing between key resource theories, multiple-component resource theories, integrated resource models, and life span resource models. However, since multiple-component resource theories are essentially key resource theories that define their key resource based on several components, and life-span resource models are essentially integrated resource models but add a life-span perspective, a dichotomy of resource theories can be derived: key resource theories on the one hand and integrated resource models on the other hand (see Table 2-2).

Table 2-2   Psychological resource theories

Key resource theories	Integrated resource models
Self-efficacy (e.g., Bandura, 1997)	Person-environment fit theory (French, Rogers, & Cobb, 1974)
Dispositional optimism (e.g., Scheier & Carver, 1992)	Resource theory of social exchange (Foa & Foa, 1976, 1980)
Social support (e.g., Barrera, 1986; S. Cohen & Wills, 1985)	Salutogenic model of health (Antonovsky, 1979)
	Transactional stress and coping model (Lazarus & Folkman, 1984b)
Multiple-component (key) resource theories	Conservation of resources theory (Hobfoll, 1988, 1989b)
Sense of coherence (Antonovsky, 1984, 1996)	
Personality hardiness (Kobasa, 1979)	*Life-span resource models*
	Selective optimization with compensation theory (Baltes, 1987, 1997)

A variety of discrete *key resources* have been studied in terms of their effect buffering illness and promoting health and well-being. Self-efficacy is one of the most prominent key resources (Bandura, 1997, 2001). Many key resource theories (including self-efficacy) relate to aspects of control, generally stressing the importance of perceived internal control (Hobfoll, 2002; Skinner, 1996). Also, key resources often describe dispositions or personality traits, such as (again) self-

efficacy, dispositional optimism (Scheier & Carver, 1992), self-esteem (Rosenberg, 1985), personality hardiness (Kobasa, 1979), or sense of coherence (Antonovsky, 1979, 1996; Schnyder, Büchi, Sensky, & Klaghofer, 2000). It needs to be noted that as traits, these resources are considered to be mostly stable over time. Hence, key resource theories are rather static and deterministic; they can only state whether the respective resource has an influence, and to which extent an individual has that resource (permanently) available. Consequently, they focus on stability rather than change. An exception to the trait-related key resources is social support (Barrera, 1986; S. Cohen & Wills, 1985), which is rather perceived as an environmental factor and a process (Hobfoll, 2002), although there are indications that social support, too, is impacted by certain personality traits (Newcomb, 1990). Sense of coherence and personality hardiness are listed in Table 2-2 as multiple-component key resource theories, since they are designed to comprise multiple facets: sense of coherence comprises comprehensibility, manageability, and meaningfulness (Antonovsky, 1984), while personality hardiness embraces commitment, control, and challenge (Kobasa & Puccetti, 1983).

Clearly, these investigations into single moderating variables are important and insightful; for example, they help to explain individual differences in stress resilience. When developing a complete model of stress and well-being, however, these key resources cannot be regarded independently; this one-dimensional perspective completely ignores any potentially additive or interactive effects of multiple resources. Kobase and Puccetti (1983), who propose personality hardiness as a key resource theory, acknowledge that "the question about the *joint effectiveness* of two or more of these moderating variables is important for more comprehensive understanding of how some persons remain healthy despite their encounter of stressful events" (p. 839). Hence, a second class of resource theories comprises *integrated resource models*, which Hobfoll (2002) defines as theories that view resources "as

part of a greater dynamic process associated with well-being trough the general use of resources" (p. 311). Specifically, "these models tend to (a) look at resources broadly, rather than focusing on a specific resource; (b) view resource change in the face of stressful challenges as a key operating mechanism by which well-being and health are influenced; and (c) view the possession of reliable resource reservoirs as critical in promoting and maintaining well-being and health" (Hobfoll, 2002, p. 311).

The first of these integrated resource models, person-environment (P-E) fit theory, was developed to explain successful human coping and adjustment despite conditions of strain (French et al., 1974). The novelty of the theory—compared to the other integrated resource models—lies in combining a differential, person-centered approach with the insight that individual resources need to be considered in the context of the environment. Specifically, (P-E) fit theory highlights the importance of a *fit* (a) between an individual's abilities and the abilities demanded by that individual's environment, and (b) between an individual's motives and the extent to which these are supplied for by the individual's environment (French, Caplan, & Van Harrison, 1982). In any case, a low fit between person and environment, with the result that either abilities fall short of demand or motives exceed supply (both cases describe a deficiency of resources), causes strain. Where P-E misfit is described by either abilities exceeding demand or motives going below supply (cases of resources excess), the resource in question determines whether strain continues to decrease to show a monotonic relationship, remains stable to reveal an asymptotic relationship, or increases to form a U-shaped curve (French et al., 1982); these three hypothetical shapes are depicted as curves C, B and A (in order of their mentioning) in Figure 2-5. This differentiated consideration of possible misfit constellations is the second novel aspect of the theory. In addition, French et al. (1982) allow for and distinguish both objective P-E fit or strain, based

on objective assessments of person and environment situations, and subjective P-E fit or strain, based on subjective assessments (French et al., 1974); notably this thinking is in line with COR theory's definition of stress (as discussed in chapter 2.2). As a downside, P-E fit theory places little emphasis on identifying and describing the specific resources or resource classes.
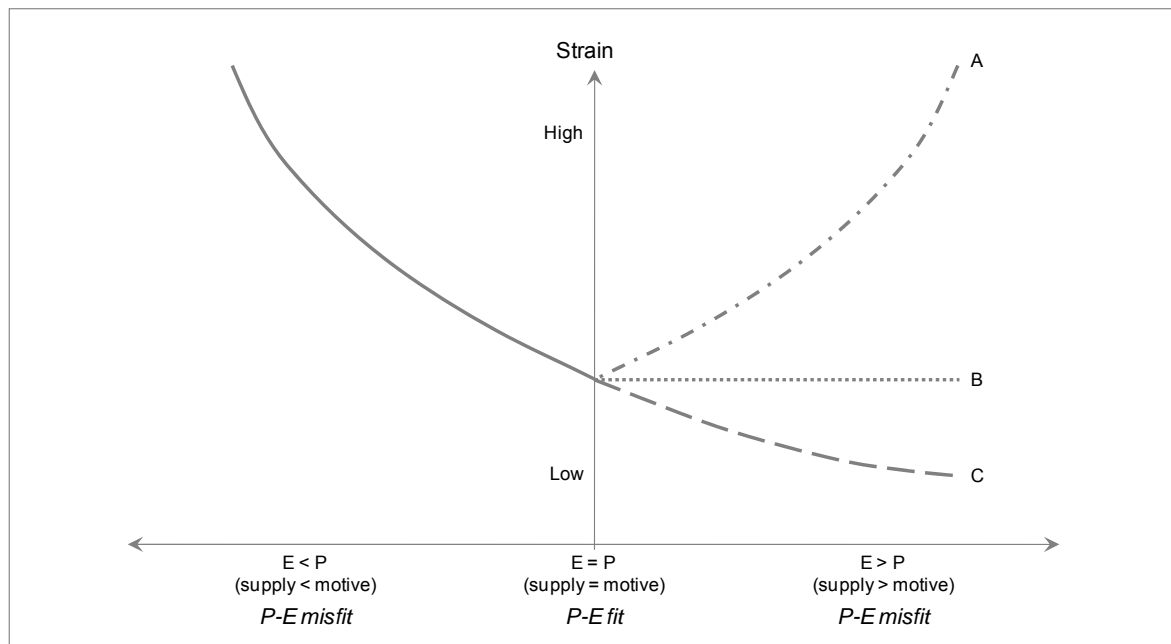
Figure 2-5 **Three hypothetical shapes of the relationship between P-E fit and strain (French et al., 1982)**

In contrast to P-E fit theory, Foa and Foa's (1976; 1980) resource theory of social exchange focuses on the resources and their qualities. The resource theory of social exchange is essentially an extension of the economic model of the marketplace—which is a central platform for the exchange of resources—to all interpersonal situations: "interpersonal behavior is […] almost synonymous with resource exchange", so that "any given behavior can be described and analyzed in terms of the resources that compose it" (Foa & Foa, 1980, p. 81). These resources are divided into the six resource classes of love, status, information, money, goods, and services. Furthermore, Foa and Foa (1980) propose distinguishing these six resource

classes according to the two continuums of (1) concrete versus symbolic and (2) particularistic versus universal. They suggest that two resources that are relatively close to one another along both continuums are more likely to be exchanged or substituted with one another (see Figure 2-6). Another noteworthy distinction between the resources is based in the observation that when giving money, the receiver's gain is the giver's loss (a negative relationship), but when giving love, both the receiver and giver gain (a positive relationship). In other words: "an exchange of money can be a zero-sum game, but an exchange of love cannot" (Foa & Foa, 1980, p. 85).
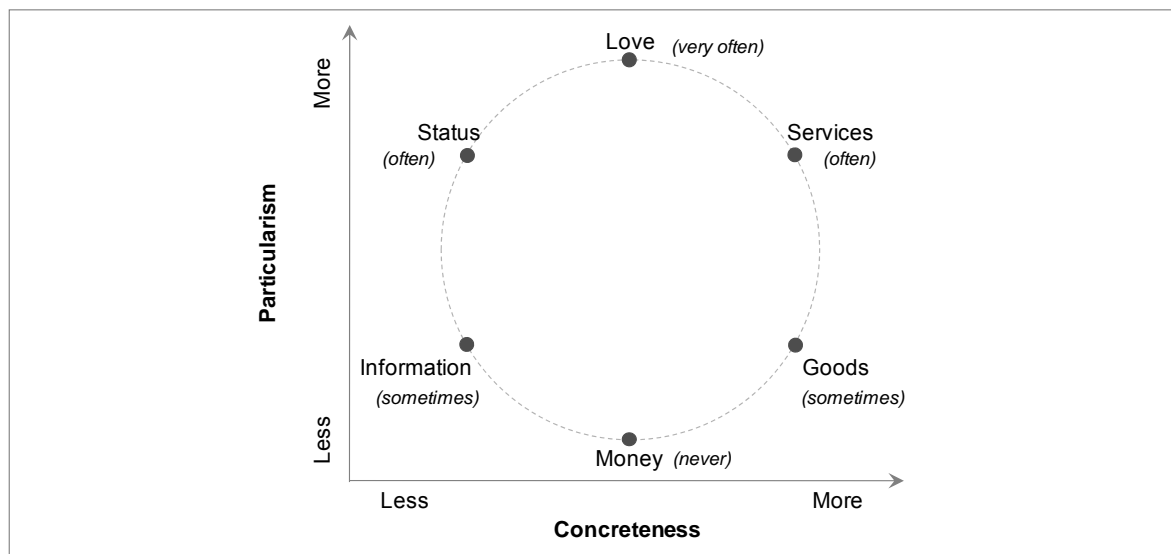
Figure 2-6   Classification of resources, including an assessment of how often giving and taking go together (Foa & Foa, 1976)

The novel contribution here is that resources invested do not necessarily diminish, and that through a dyadic exchange the absolute amount of resources may even be increased—an idea that hints towards the possibility of gain cycles. Figure 2-6 indicates, for each resource class, the likelihood that giving and taking go together (in brackets). Foa and Foa (1980) suggest yet another distinction between resource classes: money and love (as two extremes) are different in that money can "be separated from the interpersonal situation, kept for a long time in the absence of actu-

al exchange, or transmitted by an intermediary without incurring a loss" (p. 85), while love cannot. Finally, the resources differ in the time they take for processing as well as in the delay of reward following their investment (Foa & Foa, 1980).

Antonovsky's (1979) salutogenic model of health represents a paradigm shift in that it explicitly proposes to focus on salutogenesis and health, rather than on pathogenesis and disease. Specifically, he proposes the existence of eight types of generalized resistance resources (GRRs): (1) physical and (2) biochemical, e.g., immunopotentiators; (3) artifactual-material, e.g., money or shelter; (4) cognitive and (5) emotional, e.g., knowledge-intelligence or ego identity; (6) valuative-attitudinal, i.e., coping styles; (7) interpersonal-relational, i.e., social support and commitment; and (8) macrosociocultural resources, e.g., culture or religion. Beyond these GRRs, there are also *specific* resistance resources. These are made accessible by the GRRs: "being literate or being rich—which I see as a GRR—opens the way to exploitation of many specific resistance resources—for example, knowing one's way around a hospital bureaucracy" (Antonovsky, 1979, p. 100). Therefore, the availability of these GRRs plays a crucial role in an individual's position and progress on the health-disease continuum. On the one hand, the absence of a GRR is a stressor, which is pictured as an increase in positive entropy, i.e., disorder. The availability of GRRs, on the other hand, provides negative entropy, i.e., decreases the level of disorder experienced by the individual. Notably, there is an intervening variable between the GRRs and successful tension management: sense of coherence. The availability of GRRs is a major determinant of the key resource sense of coherence: "a generalized resource 'works' […] because it provides life experiences which promote a strong sense of coherence" (Antonovsky, 1984, p. 5). Since later publications shift most of their attention from the GRRs to the sense of coherence, these parts of Antonovsky's work were previously listed as a key resource theory (Antonovsky, 1984, 1996).

Lazarus and Folkman's (1984a; 1984b) transactional theory of psychological stress and coping identifies two processes that mediate stress: (1) cognitive appraisal and (2) coping. This qualifies as an integrated resource model: cognitive appraisal describes the process of evaluating whether a specific event is likely to exhaust or exceed a person's resources, and coping denotes the cognitive or behavioral process to respond to the events that have been identified as harm, threat, or challenge. The resources that are valued in the appraisal process are three-fold: personal resources such as skills, energy, stamina; environmental resources such as social networks, money, and institutional support; and personality traits including motive patterns, belief systems, cognitive styles, intelligence, and social competence. While the transactional model does not elaborate on the nature and behavior of the resources, it introduces the novel insight that resources are appraised. The tautological implications of subjecting both demand and resources to appraisal have been discussed in chapter 2.2. Nonetheless, thinking of resources as existing in the eye of the appraiser rather than in an objectively measurable way is an important complement to resource theories.

Life-span resource theories differ only in that they are motivated by the attempt to understand the nature of psychological aging; hence, they take a more long-term perspective to resources. The most frequently referenced life-span resource model is the selective optimization with compensation (SOC) theory (Baltes, 1987, 1997). SOC is related to resources, since *selection* means the choosing of specific goals, *optimization* entails the investment of resources in order to achieve the selected goals and *compensation* refers to the investment of resources to offset the loss of other resources in order to maintain functioning (Hobfoll, 2002). Hence, both optimization and compensation processes imply the investment of resources, but while the investment in the optimization paradigm is the proactive pursuit of personal goals, the investment in the compensation paradigm "involves accepting

certain deficits and implementing efforts […] to overcome resource inadequacy" (Hobfoll, 2002, p. 313). An outstanding contribution of SOC theory is seeing resources in the light of (a) life-span development and (b) culture and evolution (Hobfoll, 2002). On the former, Baltes (1997) proposes a systematic life-span shift in the relative allocation of resources to the three functions of development: growth, maintenance (resilience), and regulation of loss. Specifically, "in childhood, the primary allocation is directed toward growth; during adulthood, the predominant allocation is toward maintenance and recovery (resilience); in old age, more and more resources are directed toward regulation or management of loss" (p. 370). Particularly in old age, it is critical that the inevitable resource loss can be offset by a successful mobilization of the remaining resources (Hobfoll, 2002). Regarding the latter concept, Baltes (1997) finds that resources are rooted in culture and evolution. Hence, culture or culture-based resources refer to "the entirety of psychological, social, material, and symbolic (knowledge-based) resources that humans have generated over the millennia, and which as they are transmitted across generations, make human development possible as we know it today" (p. 368). Consequently it is the collective increase of culture-based resources—such as literacy and technological innovation—over time and generations that is responsible for the increasingly higher functioning in human ontogenesis (Baltes, 1997).

After reviewing these five integrated resource models and examining their similarities, differences, and relationship to COR theory, several observations can be made. First, the models do not agree on the number or labels of the resource categories. Foa and Foa (1980) suggest six resource classes and are biased towards 'tradable' resources (in terms of COR theory resources: energy and material resources), since they come from a market exchange perspective. They do not include any personal characteristics within their resource classes. Antonovsky (1979), on the other hand, proposes eight resource classes that cover COR theory's

personal characteristics, material resources, and condition resources, but disregard energy resources. Finally, Lazarus and Folkman (1984b) indirectly propose three resource categories. In terms of COR theory resources they emphasize personal characteristics, condition resources, and energy resources, while neglecting material resources. Overall, COR theory seems to be integrative in the sense that it compasses all resource classes defined by these three models—with one exception. While COR theory does not explicitly incorporate social resources (see chapters 2.1 and 2.5), the other three models include the notion of social support by postulating (a) a mechanism of social exchange and love as a resource (Foa & Foa, 1980), (b) interpersonal-relational resources (Antonovsky, 1979), or (c) environmental resources such as social networks and social support (Lazarus & Folkman, 1984b).

Considering the mechanisms of resources, COR theory comes closest to SOC theory. In COR theory, resources are invested to prevent or minimize resource losses (similar to SOC's compensation mechanism) or to build resource surpluses (similar to SOC's optimization mechanism). It could be argued that SOC theory goes one step further than COR theory, as it understands the pursuit of personal goals as the ultimate motivation. It could be equally countered that COR theory is more parsimonious as it conceives motivation based on resources instead of a goals as a second concept. A second characteristic of resources according to COR theory, i.e., gain spirals, gains some support from the resource theory of social exchange (see Figure 2-6). One of the most important contributions of COR theory is the insight that resources can create other resources, and that loss of resources promotes further loss. Third, COR theory's resource-based definition of stress and eustress are most similar to the salutogenic model. Antonovsky (1979) considers the absence of a resource to create stress, and the availability of resources to provide for successful tension management and ultimately health. Similarly, in COR theory, the loss (absence) of a resource generates stress, while resource surpluses promote eu-

stress. In contrast, both the resource theory of social exchange and the transactional model take a homeostatic approach, emphasizing that a misfit between demand and capabilities (or between supply and motives) causes stress, while a fit endorses satisfactory states.

As a final comment in this chapter, one further criticism of COR theory must be raised – namely, that COR theory neglects the P-E fit theory's proposition of different shapes of the relationship between resource levels and strain, although inclusion of this aspect would have been beneficial. In detail, COR theory assumes that any resource gain or surplus creates eustress (or a reduction of stress); hence, it universally assumes a monotonically decreasing shape C as in Figure 2-5. However, French et al.'s (1982) proposition of two alternative shapes A and B—though more complex—appears more realistic. French et al. (1982) further suggest that the monotonic relationship C, that COR theory proposes, applies only to resources that are either preservable for future use or exchangeable for other resources. In contrast, the asymptotical relationship B is appropriate for resources that have a defined maximum, such as food intake or personal growth, and the U-shaped relationship A pertains to resources which are complementary to other resources such that excess supply of one resource diminishes supply of another resource (e.g., excess of time for work diminishes time for leisure or family). Notably, the resource discrimination dimensions 'particularity' and 'concreteness' suggested by the resource theory of social exchange (see Figure 2-6) might serve as a conceptual basis to advance this thinking. Overall, it is yet not obvious why Hobfoll (1989b) refrained from incorporating this enriching view on different relationship shapes in COR theory. The following chapter will extend this discussion.

2.5   Caveats and criticism of COR theory

Several advantages of COR theory need to be acknowledged. First, it offers an alternative and integrative approach to cognitive-appraisal and environmental approaches to stress theory (see chapter 2.2). Second, it takes a resource-based approach; this makes the theory very tangible, and is very much in line with current thinking (see chapter 2.4). Third, it does not take a one-sided view of stress, but treats loss and gain, stress and motivation, as two sides of the same coin (see chapter 2.2). The fact that COR theory has been widely cited for the past 23 years confirms that it is a very appealing, intuitive, and heuristically useful theory. On the downside of this, there are still several unsolved caveats and critical issues: (1) the notion that the theory is overly general; (2) the claim of COR theory to be a comprehensive theory of stress, including the claim that there is no stress without loss; (3) the question of whether the suggested resource categories can be considered exhaustive, and if it is in fact viable to exclude social support; (4) the assumptions that resources increase indefinitely and that resource growth indefinitely creates eustress; (5) the postulate that the appraisal of resources is limited and has only minor effects; and (6) the assumption that when deciding to invest resources for coping, humans rationally and efficiently balance losses versus gains. Notably, these caveats are listed here in order from a very general level to rather specific technicalities. Most of these have been briefly touched upon within the preceding chapters and will be further discussed in the following paragraphs.

First, COR theory may be criticized for taking a very *broad approach*. It describes processes on a general and abstract level—e.g., without specifying which resources in which domains are most meaningful (Buchwald & Hobfoll, 2004). The original publication of the COR model in 1989, in particular, "concentrated on its inclusive nature, its distinctiveness and basic principles but, did not specifically relate to any particular setting" (Westman et al., 2004, p. 170). Theories with a high

level of generalizability and abstraction often have the drawback of lacking the level of detail required for precise predictions in specific situations (Bacharach, 1989). This is problematic for two reasons: first, general theories do not provide additional insights and hence lack utility; second, they are not testable and hence not falsifiable due to the absence of tangible predictions. However, this circumstance may be interpreted equally as a limitation and opportunity of the model: by taking a general approach, it suits a broad range of research questions. Bacharach (1989) describes the paradox with regard to organizational theories: "some of the most abstract and broad perspectives on organizations, while not necessarily rich in detail, have provided a critical basis for cumulative research" (p. 500). In this vein, the global COR theory needs to be specified or 'instantiated' depending on the application domain. This has already been done in a number of applications, including traumatic stress (Hobfoll, 1991), public health promotion (Hobfoll & Schumm, 2009), burnout (Buchwald & Hobfoll, 2004), stress and management in the workplace (Hobfoll & Shirom, 2000), and in several subdomains of organizational behavior (see Westman et al., 2004, for a review). The development of a resource evaluation scale specific to COR theory (Hobfoll et al., 1992) additionally contributes to the testability and hence falsifiability of the theory.

A second criticism is that Hobfoll (1989a) claims that COR theory is a "comprehensive theory of stress" (p. 518); this implies that resource loss is central to all psychological stressors and is alone sufficient to explain stress. Conversely, factors and events unrelated to loss cannot result in stress. This supposition can be challenged from two different angles. The first angle concerns Hobfoll's argument that loss events are the *universal* cause of stress. Hobfoll (1989a) refers to having reviewed the major stressful life event surveys (such as B. S. Dohrenwend et al., 1978; Holmes & Rahe, 1976), finding that most of the items are loss-events, and that loss-events have the strongest severity weightings. Consequently, Hobfoll

(1989a) explicitly disqualifies events of change, transition, or challenge as causes of stress: "change, transitions, and challenge are not of themselves stressful" (p. 518). He qualifies that transition events such as a business readjustment are either recorded as gains—e.g., when they denote an increase in power, money, or positive challenge—or they are perceived as losses and hence create stress. However, research in the domains of organizational change (e.g., Ashford, 1988) and clinical psychology (e.g., Dugas, Schwartz, & Francis, 2004; Greco & Roger, 2003) suggests that the mere uncertainty and ambiguity accompanying change or transition are sufficient to create stress. Hence even positively connoted events, such as graduating from college or starting a new job, can create stress by producing uncertainty about daily activities and causing disruptions that require the individual to adapt by developing new skills (Ashford, 1988). In this vein, Holmes and Rahe's (1976) scale of stressful events includes items such as "outstanding personal achievement", "marriage", "vacation", and "change of residence"; hence they define stress as any circumstance "whose advent is either indicative or requires a significant change in the ongoing life pattern of the individual" (p. 217). On the other hand, it has been found that the relationship between change-related uncertainty and psychological strain is partially mediated by feelings of lack of control—i.e., a loss-event (Bordia, Hunt, Paulsen, Tourish, & DiFonzo, 2004). While it is important to determine whether loss is sufficient for stress, there is a certain risk that to enter a purely terminological and definitional discussion—e.g., what exactly is an event of change and when does it entail actual or potential loss?

The second angle from which the comprehensiveness of COR theory as a stress theory may be challenged is based on findings that life events explain only small to modest amounts of variance in stress and illness (B. P. Dohrenwend, 2006; Paykel, 2001; Rabkin & Struening, 1976). Paykel (2001) concludes that "although events are important, a large part in determining whether an event is followed by

disorder must be attributed to other modifying factors, both genetic and environmental, ranging from biochemical through personality and coping mechanisms to social experiences, early or recent" (p. 144). This thinking is in line with the paradigm shift from monocausal models to multicausal, integrative vulnerability-stress models for the etiology of abnormal psychology (most prominently suggested by Zubin & Spring, 1977). However, Hobfoll (1989b) implicitly limits the scope of COR theory to exclude biological vulnerability, stating: "Brown and Andrews (1986) reported that other than in cases of depression where the disorder is likely to be dispositional, loss events are responsible for approximately 90% of the cases of depression they studied" (p. 518).

As a final remark on the issue of comprehensiveness, it needs to be pointed out that Hobfoll (1989b) does not specify whether he considers COR theory also to be a 'comprehensive theory of *motivation*' and hence regards resource gains as sufficient to explain motivation. Since COR theory so strongly claims to be comprehensive regarding stress, it would be desirable to evaluate whether it also qualifies as comprehensive regarding motivation.

Third, it can be questioned whether the four suggested *resource categories* (objects, conditions, person characteristics, and energies) are exhaustive. For example, social support is (deliberately) not included in any of the four categories, since Hobfoll views social support as ambivalent, i.e., both beneficial and harmful (Hobfoll, 1989a). However, this view strongly contradicts findings from other fields, such as clinical psychology (e.g., Brugha, 1995) and hedonic psychology (e.g., Argyle, 1999), which identify social support as an essential promoter of psychological health and well-being. Notably, though, Hobfoll later amended his view on the unimportance of social support, acknowledging that "social support is more complex than was first visualized, but it may also be more integral to health and well-being than was also originally thought" (Hobfoll et al., 1990, p. 476) and

putting forward a "social support resource theory" (Hobfoll & Freedy, 1990; Hobfoll et al., 1990; Hobfoll et al., 1992). However, while these latter three publications elaborate on the importance of social resources and social support, Hobfoll never explicitly proposed creating a fifth resource category for social resources or including social support within one of the four existing resource categories. Rather, social resources continue to be described as "interrelated to personal resources", and the social support resource theory is presented as a deduction that "follows directly from COR theory" (Hobfoll et al., 1990, p. 476). Hence, social resources and the social support resource theory are neither *integrated* into COR theory nor clearly *demarcated* from it; as such, the role of social support in COR theory remains unsettled. Similarly, the COR evaluation scale (COR-E) does include several items of social support—such as "loyalty of friends", "family stability", and "support of co-workers" (Hobfoll et al., 1992). But since the scale's resources are not assigned to the four (or five?) resource classes, but presented as a long-list, it is again not possible to infer how social resources should be interpreted from a COR theory perspective.

Fourth, COR theory lacks specificity regarding the *curve progressions* of loss and gain spirals. As addressed in chapter 2.3, four different types of curve progressions are generally possible (also refer to Figure 2-7): (1) a *linear* progression, in which resource gains (once initiated) advance at the same rate; (2) an *exponential* progression, in which resource gains progress at an increasing rate; (3) an *asymptotic* progression, in which resource gains proceed at a decreasing rate and gradually approximate a maximum resource level; and (4) a *parabolic* progression, in which resource gains advance at a decreasing rate up to a point where they turn into resource losses. Hobfoll's theoretical studies implicitly suggest an exponential progression, e.g.: "these spirals move with increased strength and speed as individuals, groups, and organizations […] acquire resources so they can risk looking

for new challenges to meet" (Hobfoll, 2011, p. 118). Research from other domains, however, suggests asymptotical curves; this research includes e.g., set-point theory and effects of habituation in the context of subjective well-being (e.g., Diener & Fujita, 1995), the laws of diminishing returns and diminishing marginal utility (e.g., R. E. Lane, 2000; Seligman & Csikszentmihalyi, 2000), the idea of cybernetics, that deviation-amplifying loops often become deviation-counteracting loops which results in an equilibrium (Edwards, 1992; Maruyama, 1963), and countervailing processes that close off the accumulation of advantage in the context of the Matthew effect (Merton, 1988). Merton (1988) also points out that exponential growth does not continue endlessly, but that often the mistake is made of extrapolating (exponential) growth processes within a local range to outside that range.
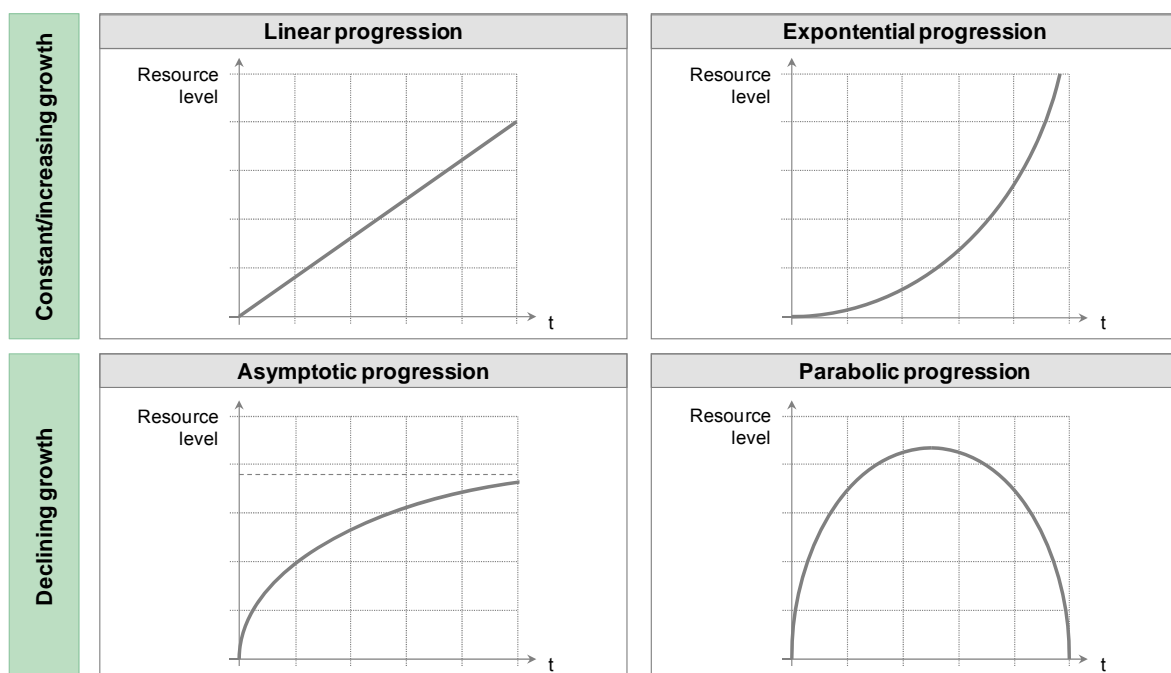
Figure 2-7   Four schematic growth curves

Some intuitive examples support the notion that at least a subset of resources adheres to an asymptotical gain curve; personal health, for example, cannot increase indefinitely, but is expected to grow asymptotically up to a point of total health.

Personal wealth, on the other hand, can more easily be imagined as relatively limitless—although the idea of diminishing returns on financial investments would also suggest a decelerating gain spiral. Hence, a more differential approach would be useful for resource-based theories such as COR theory. Support can be drawn from Maslow, who in his theory of human motivation distinguishes between two types of needs: deficiency needs (e.g., physiological needs), which are sought after until a homeostatic level is met, and growth needs (e.g., self-actualization), which are not tied to homeostatic levels, but are sought after unlimitedly once all deficiency needs are met (Maslow, 1943; Wahba & Bridwell, 1976). Similarly, Seligman and Csikszentmihalyi (2000) make a distinction between pleasure and enjoyment: "pleasure is the good feeling that comes from satisfying homeostatic needs such as hunger, sex, and bodily comfort; enjoyment, on the other hand, refers to the good feelings people experience when they break through the limits of homeostasis" (p. 12). Sound analyses of the curve progressions of loss and gain spirals would surely be insightful and serve a deeper understanding of resource spirals.

While the above issue touches on the growth of resources relative to time, a related problem concerns the growth of eustress relative to the growth of resources. While Hobfoll (1988; 1989b) suggests that resource surpluses indefinitely create eustress, it must be discussed whether this is truly plausible. The law of diminishing marginal utility would instead suggest that each additional unit of resources would create less additional eustress than the previous unit of resources. On this issue Seligman and Csikszentmihalyi (2000) state that "a point of diminishing returns is quickly reached in many instances, ranging from the amount of income one earns to the pleasures of eating good food." Similarly, P-E fit theory suggests that different resources may form different relationships with strain (as discussed in chapter 2.4). It could even be argued that the acquisition of an additional unit of one resource could result in losses of eustress, because it is acquired at the expense

of other resources. Hobfoll (2002) himself argues: "there may also be a threshold for some resources after which having more is not advantageous but still requires energy and effort; unfortunately, there is little research on this latter concept of resource thresholds" (p. 316).

Fifth, there is a lack of clarity concerning the *appraisal of resources* in COR theory. Hobfoll apparently embraces the notion of reappraisal to *some* extent, but not fully; he suggests that resource loss can be mitigated either by shifting the focus of attention or by devaluing the potentially lost resources. Hobfoll (1989a) makes two strong points regarding the limits of appraisal: (1) "even when perception is important, normative tendencies regarding how resources are evaluated and what constitutes loss guide individuals' assessments of their environments and their selves" (p. 519), and (2) "although minor reappraisals may allow individuals to buffer the brunt of stressors, reappraisal of more basic aspects of the self and the environment are more likely to backfire against the individual—resulting in a sense of insecurity and despair" (p. 520). However, this reluctant attitude towards the appraisal of resources stands in contradiction with other resource-based research that ascribes a very prominent role to the individual appraisal of resources. Research by Diener and Fujita (1995), for example, shows that the importance of a resource centrally depends on whether the resource is related to an individual's major goals.

Sixth and finally, COR theory does not clearly define the process underlying the replacement of lost resources and the investment of resources. Hobfoll (1989a) suggests that in order to prevent a negative balance between resources employed for coping and resources gained through coping, "people roughly judge their potential losses, determine what they stand to lose by expending other resources, and analyze the likelihood of succeeding or offsetting losses if they choose to employ a given coping strategy" (p. 519). However, it has not been specified which

strategies people employ to tackle this rather complex computation task. Are these choices conscious or subconscious? Are they rational? How efficient and successful are the choices? Are there any variables that allow individuals to make more or less successful replacement decisions? These same questions can be posed regarding the process of investing resources in order to achieve net-gains. Research on the processes behind these decisions is yet to be done.

In conclusion, several issues regarding COR theory remain to be clarified or reconciled. The generalness of COR theory is ultimately not problematic in itself, since other researchers continue to apply the theory in various fields to develop more specific instantiations. Several other claims, however, are more problematic and need to be reconciled with other theories in the field. These are the claims that (a) there is no stress without loss, (b) the appraisal of resources is limited, and (c) the four suggested resource categories are exhaustive. However, these claims are primarily theoretically relevant. More practically relevant and thus requiring empirical research are the issues regarding (a) decision processes underlying resource investment decisions, and more importantly (b) the progression of resource gain spirals over time. This latter issue will be addressed in the following literature review of gain spiral research and in the empirical studies conducted within the scope of this thesis.

3 Gain spirals

It has been pointed out that gain spirals have received considerably less attention than loss spirals (Hobfoll, 2011, p. 118). In particular, they have rarely been *empirically* studied. Two reasons for this neglect can be found in the literature (e.g., Hobfoll, 2011): (a) the traditional prevalence of a pathogenic perspective in psychology and (b) the empirical finding that loss is generally more salient than gain (which has been discussed in chapter 2.3.1).

In order to validate, elaborate upon, and transfer gain spirals to psychological praxis, however, a sound empirical foundation is indispensible. The following literature review provides a valuable overview of the existing empirical studies on gain spirals, including their contributions and limitations. Guidelines for future research are then deducted from the major findings of the literature review. These guidelines are intended to (a) provide general orientation for any future empirical studies on the topic and (b) provide the specific basis for the empirical study of gain spirals included in this thesis.

3.1 Research status quo: literature review of empirical evidence

3.1.1 Selection of studies

A deliberately wide focus was adopted in the search for relevant studies, since the literature suggested that studies on gain spirals were scarce. Hence, the only conditions were that the studies needed to explicitly refer to "gain spirals" (the first key word) and to Hobfoll/COR theory ("Hobfoll" was the second key word). Studies addressing gain spirals *solely* on the basis of theories other than COR theory were thus excluded. However, it was not a condition that studies focus solely on

COR theory; in fact, most selected studies are based on several gain spiral-related theories, including COR theory.

A search for the combined search strings "gain spiral" and "Hobfoll" was conducted using Google Scholar. The coverage of academic publications via Google Scholar has been repeatedly reviewed and was for some time controversial; recently, however, a sound coverage has been substantiated by Chen (2010). The search was conducted in English, since (a) COR theory is of American origin and (b) English is the predominant language for academic publications in psychology today.

The search originally produced 109 publications that fulfilled the two defined search criteria (as of September 2011). A manual examination of the 109 items identified *15 relevant results*. The remaining Google Scholar search results were not relevant; most only circumstantially referred to Hobfoll's notion of gain spirals, e.g., a single mention within the theory or discussion section of a publication. A *backward search* (e.g., suggested by Webster & Watson, 2002) within the citations of the 15 relevant studies revealed an additional three relevant studies that fulfilled the two conditions and addressed gain spirals as the central topic. A forward search, e.g., using the Social Sciences Citation Index, was not performed, since the majority of the identified studies have only been published very recently: ten out of the total of 18 relevant studies are dated between 2009 and 2011, and the "oldest" of the 18 studies was published in 2004.

Regarding content, all of the 18 relevant studies relate to the vocational domain, i.e., to the occupational and organizational disciplines. Of these, eleven studies are empirical studies; these are included in the scope of the following critical review. The remaining seven studies are theoretical works that engage with the theoretical basis of gain spirals and extend the concept to new fields within the vocational domain. The predominant field is work engagement. Four of the theoretical stud-

ies postulate a gain spiral between job resources and/or personal resources and job engagement, suggesting that an increase in job and/or personal resources leads to an increase in job engagement, which in turn causes an additional increase in job and/or personal resources (Bakker & Demerouti, 2008; Gorgievski & Hobfoll, 2008; Salanova et al., 2010; Van den Heuvel, Demerouti, Schaufeli, & Bakker, 2010). The other three theoretical works apply COR theory's conceptualization of gain spirals to (a) the preconditions of entrepreneurial success (Gorgievski & Laguna, 2008), (b) the motivation for workplace bullying behavior (Wheeler, Halbesleben, & Shanine, 2010), and (c) several aspects of respite research (Westman et al., 2004). Since these theoretical works to do not contribute to the empirical confirmation of gain spirals, however, they will not be considered further.

3.1.2 Review of studies

Two noticeable aspects of the eleven empirical works on resource gain spirals are (1) their temporal concentration and (2) their thematic concentration. All eleven studies have been published within the past six years (between 2005 and 2011); nearly half of the studies (five studies) even fall within the last two years (2010 and 2011). This fact confirms the high topicality and relevance of empirical research on gain spirals. Additionally, the recency of this field of research underlines the importance of a literature review which captures the early findings to develop guidelines for future research in the field. The thematic concentration, on the other hand, reflects the fact (mentioned above) that all publications pertain to the vocational domain and predominantly focus on work engagement. Moreover, the thematic concentration reflects the relatively few authors currently publishing in this field: seven of the eleven empirical studies include the authorship of Arnold Bakker (University of Rotterdam) and/or Wilmar Schaufeli (University of Utrecht), both professors of work and organizational psychology.

Despite the high thematic concentration, the eleven studies may be further divided into four thematic clusters. The studies in the *first cluster* investigate the direct (reciprocal) relationship between work resources and work engagement. The studies in the *second cluster* essentially consider the same relationship between work resources and work engagement, but include self-efficacy as a key resource in their analysis. The *third cluster* studies even broader interrelations between work resources, work engagement, and a number of additional variables. Finally, the studies in the *fourth cluster* examine resource gain spirals beyond work engagement, though still within the vocational domain. Organized into these four clusters, the eleven studies will be briefly introduced in the following paragraphs. In addition, Table 3-1 summarizes the design parameters for each of the empirical studies, including (1) research domain (mostly work engagement), (2) methodological information regarding the sample, variables, and data collection times (i.e., number of waves and time-lag), and (3) results in terms of gain spirals that could be empirically confirmed.

First cluster: work resources and work engagement

The three studies in the first cluster explore the reciprocal relationship between work resources and work engagement (Bakker & Bal, 2010; Schaufeli et al., 2009; Weigl et al., 2010). These studies are based on the hypothesis that work engagement is both a result *and* a prerequisite of work resources. The study by Schaufeli et al. (2009) operationalizes work resources via (1) social support, (2) autonomy, (3) opportunities to learn and develop, and (4) performance feedback. Work engagement is measured via self-reported levels of vigor and dedication. The relationship between work engagement and work resources is investigated in a sample of 201 managers of a Dutch telecommunications company; both work engagement and work resources are measured at two points in time (T1 and T2), with an

interval of one year. Based on a structural equation model, the authors find a reciprocal relationship between work resources (aggregated) and work engagement. Specifically, the subjects' work engagement in T1 has a significant positive effect on the increase of their work resources between T1 and T2, which in turn has a significant positive effect on their work engagement in T2.

The study by Bakker and Bal (2010) explores the relationship between work engagement and work resources in 54 teachers at several Dutch primary schools. The operationalization of work resources and work engagement is similar to the study above: work resources include (1) autonomy, (2) exchanges with the superior, (3) opportunities for development, and (4) social support; work engagement is measured based on vigor, dedication, and absorption. In this study, however, the authors investigate much more immediate relationships: the study includes five waves at one-week intervals. Multi-level analyses confirm reciprocal relationships between work engagement and three of the four work resources: one week's work resources (excluding social support) each have a significant positive effect on the same week's work engagement, while one week's work engagement has a significant positive effect on each of the next week's work resources (including social support).

The third study within the first cluster (Weigl et al., 2010) investigates a sample of 416 German hospital physicians. The authors measure work engagement and work resources at three points in time, with time-lags of 14 months (between waves one and two) and 19 months (between waves two and three). As before, work engagement is determined via vigor, dedication, and absorption; work resources refer to the three key resources (1) job control, (2) positive work relationships, and (3) active coping behavior. Item-level structural equation modeling supports the hypothesized reciprocal relationships between work resources and work engagement: each of the three work resources in T1—respectively T2—

shows a positive effect on work engagement in T2—respectively T3—(five out of six possible paths are significant), while work engagement in T1—respectively T2—shows a positive effect on each of the three work resources in T2—respectively T3—(four out of six possible paths are significant).

Second cluster: self-efficacy as key resource

The three studies in the second cluster add an additional level of complexity in that they also consider the role of self-efficacy as a key personal resource. Self-efficacy is investigated in the established context of the reciprocal relationship between work engagement and work resources. One study hypothesizes that self-efficacy is a *mediator* in the gain spiral between work resources and work engagement (Llorens, Schaufeli, Bakker, & Salanova, 2007), while two other studies hypothesize that it functions as an *initiator* of such a gain spiral (Le Blanc, Schaufeli, Salanova, Llorens, & Nap, 2010; Salanova, Bresó, & Schaufeli, 2005). Another novelty in this cluster is the broadening of the definition of work engagement: one study explores work engagement on the team level, while another study considers the academic engagement of students.

Llorens et al. (2007) study self-efficacy as a mediator in the reciprocal relationship between work resources and work engagement. They define work resources as (1) time control and (2) method control and measure work engagement based on vigor and dedication. The research is performed as a laboratory study among 110 university students in Spain, comprising two measurements with a three-week time-lag. Structural equation modeling confirms the two hypothesized relationships. First, there is a reciprocal relationship between work resources and self-efficacy: work resources (aggregated) in T1 have a significant positive effect on self-efficacy in T2, while self-efficacy in T1 shows a significant positive effect on work resources in T2. Second, there is a reciprocal relationship between self-

efficacy and work engagement: self-efficacy in T1 shows a significant positive effect on work engagement in T2, whereas work engagement in T1 has a significant positive effect on self-efficacy in T2.

The study by Le Blanc et al. (2010) investigates self-efficacy as the initiator of a gain spiral including team commitment and collaborative practice (both of which are indirect measures of work engagement). Their sample consists of 372 intensive care nurses from 29 intensive care units across eight European countries, and is thus very strong in terms of external validity. The study, a two-wave design with a time-lag of 15 months, supports both theorized relationships. First, there is evidence for a reciprocal relationship between self-efficacy and team commitment: self-efficacy in T1 exhibits a significant positive effect on team commitment in T2, while team commitment in T1 has a significant positive effect on self-efficacy in T2. Second, there is support for a reciprocal relationship between team commitment and collaborative practice: team commitment in T1 shows a significant positive effect on collaborative practice in T2 and, in turn, collaborative practice in T1 has a significant positive effect on team commitment in T2.

The last study in this cluster pertains to an academic, rather than organizational, context. Salanova et al. (2005) analyze self-efficacy as the initiator of a gain spiral including academic engagement and self-efficacy beliefs regarding future academic success. The study is conducted among 353 university students from Spain and Belgium. Notably, the data is gathered at a single point in time. Nonetheless it supports the theorized gain spiral: structural equation modeling shows a significant positive relationship between current self-efficacy beliefs and academic engagement, and between academic engagement and self-efficacy beliefs regarding future academic success.

Third cluster: more complex interrelations regarding work engagement

The studies in the third cluster also consider the established relationship between work engagement and work resources, but add a number of additional variables to the picture (Hakanen, Peeters, & Perhoniemi, 2011; Hakanen, Perhoniemi, & Toppinen-Tanner, 2008; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). These include, for example, personal resources, home resources, or marital satisfaction.

A first study by Hakanen et al. (2008) explores reciprocal relationships between work resources, work engagement, personal initiative, and work-unit innovativeness in a sample of 2,555 Finnish dentists. Work resources are operationalized specifically for dentistry and include (1) craftsmanship, (2) pride in the profession, and (3) direct and long-term results. Work engagement is based on measures of vigor, dedication, and absorption. The study consists of two measurements with an interval of three years and lends support to two of the three hypothesized gain spirals. First, there is evidence for a reciprocal relationship between work resources and work engagement: work resources (aggregated) in T1 have a significant positive effect on work engagement in T2, while work engagement in T1 has a significant positive effect on work resources in T2. Second, the data supports a reciprocal relationship between work engagement and personal initiative: work engagement in T1 exhibits a significant positive effect on personal initiative in T2, and in turn personal initiative in T1 has a significant positive effect on work engagement in T2. The theorized relationship between personal initiative and work-unit innovativeness is only supported for one direction, and hence does not prove to be reciprocal.

A second study by Hakanen et al. (2011) draws on the same data as the first, that is, 2,555 Finnish dentists questioned twice in three years. However, the second

study reports additional variables—home resources, marital satisfaction, work-family enrichment (WFE), and family-work enrichment (FEW)—and thus investigates new reciprocal relationships. Work resources and work engagement are identical to the earlier study; home resources include (1) emotional, (2) instrumental, and (3) appraisal support from one's family/partner, and (4) social support from one's friends. The authors assume six reciprocal relationships among the investigated resources and variables, three of which are supported by the data. First, they find a reciprocal relationship between work resources and work engagement (the same result as in the first study). Second, there is evidence for a reciprocal relationship between WFE and work engagement: WFE in T1 has a significant positive effect on work engagement in T2, while work engagement in T1 has a significant positive effect on WFE in T2. Third, the data supports a reciprocal relationship between home resources and marital satisfaction: home resources in T1 show a significant positive effect on marital satisfaction in T2, whereas marital satisfaction in T1 has a significant positive effect on home resources in T2. The assumed reciprocal relationships between (a) work resources and WFE, (b) home resources and FWE, and (c) FWE and marital satisfaction are not supported.

The study of Xanthopoulou et al. (2009) investigates gain spirals between work resources and work engagement, work engagement and personal resources, and personal resources and work resources. Work resources are defined as (1) autonomy, (2) social support, (3) supervisory coaching, (4) performance feedback, and (5) opportunities for personal development; personal resources include (1) self-efficacy, (2) organizational-based self-esteem, and (3) optimism. Work engagement is based on measures of vigor, dedication, and absorption. The study has a two-wave design with a time-lag of 18 months and draws on a sample of 163 employees of a Dutch electrical engineering and electronics company. All three theorized gain spirals are supported. First, there is evidence for a reciprocal relationship be-

tween work resources and work engagement: work resources (aggregated) in T1 have a significant positive effect on work engagement in T2, and work engagement in T1 has a significant positive effect on work resources in T2. Second, the authors also find a reciprocal relationship between personal resources and work engagement: personal resources (aggregated) in T1 have a significant positive effect on work engagement in T2, while work engagement in T1 has a significant positive effect on personal resources in T2. Third, there is support for a reciprocal relationship between work resources and personal resources: work resources in T1 have a significant positive effect on personal in resources in T2, and personal resources in T1 have a significant positive effect on work resources in T2.

Fourth cluster: gain spirals beyond work engagement

The final cluster comprises the two studies that consider gain spirals not in the work engagement domain, but instead in two new vocational subdomains: flow experiences at work (Salanova, Bakker, & Llorens, 2006) and positive affect in employee-customer dyads (Zimmermann, Dormann, & Dollard, 2011). Salanova et al. (2006) investigate gain spirals between work resources and flow and between personal resources and flow. Work resources include (1) social support orientation, (2) innovation orientation, (3) rules orientation, and (4) goals orientation; the key personal resource is self-efficacy. These resources and flow experience are measured at two points in time with an interval of eight months in 258 teachers at 24 Spanish secondary schools. Structural equation modeling supports both assumed relationships. First, it supports a reciprocal relationship between work resources and flow at work: work resources (aggregated) have a significant positive effect on flow in T2, while flow in T1 has a significant positive effect on work resources. Second, it supports a reciprocal relationship between the personal resource self-

efficacy and flow at work: self-efficacy in T1 has a significant positive effect on flow in T2, an flow in T1 has a significant positive effect on self-efficacy in T2.

Finally, Zimmermann et al. (2011) study gain spirals in the context of dyadic interactions and affective crossover (also known as mood contagion). For this purpose they analyze 421 employee-customer dyads in 13 German car dealerships, involving a total of 421 unique customers and 82 unique employees. The authors measure positive affect of the customer and positive affect of the employee at two points in time: before and after the interaction, with a time-lag of 20 to 60 minutes. As a third variable, employees rate the customer behavior—i.e., how proactive, constructive and friendly the customer was—immediately after the interaction. In terms of COR theory, the authors postulate that both the customer affect and the customer behavior are *resources of the employee*, since they may impact the employee's affect. Multi-level analyses support the theorized reciprocal affective crossover between the customers and employees—partially mediated by customers' behavior: the increase in positive affect (ΔT2-T1) of the employee has a significant positive effect on the increase in positive affect of the customer; in turn, the positive affect of the customer in T1 has significant positive effect on his or her behavior during the interaction, which has a significant positive effect on the positive affect of the employee in T2.

Table 3-1   Literature review: empirical evidence for gain spirals

Cluster	Authors	Domain	Sample	Resources	Other variables	# of waves	Time-lag	Results: confirmed gain spirals
Cluster 1: Work engagement as result *and* prerequisite of work resources.	**#1:** Schaufeli, Bakker and van Rhenen (2009)	Work engagement	201 manager of a telecommunications company (Netherlands)	Work resources: (1) social support (2) autonomy (3) opportunities to learn and develop (4) performance feedback	Work engagement	2	1 year	One gain spiral: – Work engagement T1 → work resources ∆T2-T1 → work engagement T2.
	#2: Bakker and Bal (2010)	Work engagement	54 primary school teachers (Netherlands)	Work resources: (1) autonomy (2) exchange with superior (3) opportunities for development (4) social support	Work engagement	5	1 week	One gain spiral: a) Work resources week x → work engagement week x (except for social support); b) Work engagement week x → work resources week x+1.
	#3: Weigl et al. (2010)	Work engagement	416 hospital physicians (Germany)	Work resources: (1) job control (2) work relationships (3) active coping	Work engagement	3	14 months; 19 months	One gain spiral: a) Work resources T1 (T2) → work engagement T2 (T3): 5 of 6 possible paths. b) Work engagement T1 (T2) → work resources T2 (T3): 4 of 6 possible paths.

Cluster	Authors	Domain	Sample	Resources	Other variables	# of waves	Time-lag	Results: confirmed gain spirals
Cluster 2: Self-efficacy as moderator or initiator of gain spirals between work engagement and work resources.	**#4:** Llorens, Schaufeli, Bakker and Salanova (2007)	Work engagement	110 university students (Spain)	Work resources: (1) time control (2) method control Personal resources: (1) self-efficacy	Work engagement	2	3 weeks	First gain spiral: a) Work resources T1 → self-efficacy T2; b) Self-efficacy T1 → work resources T2. Second gain spiral: a) Self-efficacy T1 → work engagement T2; b) Work engagement T1 → self-efficacy T2.
	#5: Le Blanc, Schaufeli, Salanova, Llorens and Nap (2010)	Team commitment and collaborative practice	372 intensive care nurses from 29 units (8 European countries)	Personal resource: (1) self-efficacy	Team commitment; Collaborative practice	2	15 months	First gain spiral: a) Self-efficacy T1 → Team commitment T2; b) team commitment T1 → self-efficacy T2. Second gain spiral: a) Team commitment T1 → collaborative practice T2; b) collaborative practice T1 → team commitment T2.
	#6: Salanova, Bresó and Schaufeli (2005)	Work engagement	353 university students (Spain and Belgium)	Personal resources: (1) self-efficacy (current beliefs and beliefs for the future)	Academic engagement	1	/	One gain spiral: – Current self-efficacy beliefs → academic engagement → self-efficacy beliefs for the future.

Cluster	Authors	Domain	Sample	Resources	Other variables	# of waves	Time-lag	Results: confirmed gain spirals
Cluster 3: Broader inter-relations be-tween work engagement, work re-sources, and additional variables:	**#7:** Hakanen, Perhoniemi and Toppinen-Tanner (2008)	Work en-gagement	2,555 dentists (Finland)	Work resources: (1) craftsmanship (2) pride in the profession (3) direct and long-term results	Work engage-ment; Personal initia-tive; Work-unit inno-vativeness	2	3 years	First gain spiral: a) Work resources T1 → work engage-ment T2; b) Work engagement T1 → work re-sources T2. Second gain spiral: a) Work engagement T1 → personal initiative T2; b) Personal initiative T1 → work engagement T2.
	#8: Hakanen, Peeters and Perhoniemi (2011)	Work en-gagement and work-home inter-ference	2,555 dentists (Finland)	Work resources: (1) craftsmanship (2) pride in the profession (3) direct and long-term results Home resources: (1) emotional support… (2) instrumental support… (3) appraisal support… …from one's family/partner (4) social support from one's friends	Work engage-ment; Marital satisfac-tion; Work-family enrichment; Family-work enrichment	2	3 years	First gain spiral: a) Work resources T1 → work engagement T2; b) Work engagement T1 → work resources T2. Second gain spiral: a) Work-family enrichment T1 → work engagement T2; b) Work engagement T1 → work-family enrichment T2. Third gain spiral: a) Home resources T1 → marital satisfaction T2; b) Marital satisfaction T1 → home resources T2.

Cluster	Authors	Domain	Sample	Resources	Other variables	# of waves	Time-lag	Results: confirmed gain spirals
	#9: Xanthopoulou, Bakker, Demerouti and Schaufeli (2009)	Work engagement	163 employees of an electrical engineering and electronics company (Netherlands)	Work resources: (1) autonomy (2) social support (3) supervisory coaching (4) performance feedback (5) opportunities for personal development Personal resources: (1) self-efficacy (2) organizational-based self-esteem (3) optimism	Work engagement	2	18 months (average)	First gain spiral: a) Work resources T1 → work engagement T2; b) Work engagement T1 → work resources T2. Second gain spiral: a) Personal resources T1 → work engagement T2; b) Work engagement T1 → personal resources T2. Third gain spiral: a) Work resources T1 → personal resources T2; b) Personal resources T1 → work resources T2.
Cluster 4: Gain spirals in other domains (beyond work engagement).	**#10:** Salanova, Bakker und Llorens (2006)	Flow at work	258 secondary school teachers (Spain)	Work resources: (1) social support orientation (2) innovation orientation (3) rules orientation (4) goals orientation Personal resources: (1) self-efficacy	Flow at work	2	8 months	First gain spiral: a) Work resources T1 → flow T2; b) Flow T1 → work resources T2. Second gain spiral: a) Self-efficacy T1 → flow T2; b) Flow T1 → self-efficacy T2.
	#11: Zimmermann, Dormann and Dollard (2011)	Employee-customer dyads	82 employees and 421 customers in 13 car dealerships (Germany)	(1) state positive affect (PA) of customer (2) state positive affect (PA) of employee (3) customer behavior	/	2	20-60 minutes (=lengths of an employee-customer conversation)	One gain spiral: a) PA of employee ΔT2-T1 → PA of customer ΔT2-T1; b) PA of customer T1 → customer behavior → PA of employee T2.

3.2 Discussion of results

3.2.1 Contributions and strengths of the reviewed studies

The strongest contribution of the eleven empirical studies is the fact that they are the *first* studies to empirically investigate resource gain spirals since the development of COR theory in 1989. As such, they provide both a foundation and initial insights for the systematic, empirical study of the gain spiral principle as postulated by COR theory. Naturally, these early advances are not without limitations. Before considering the studies' limitations in the following chapter, however, the major strengths and insights of the studies will first be highlighted.

Despite the fact that all of the studies fall into the domain of work and organizational psychology, they still manage to create a broad and general depiction of resource gain spirals. This is due to the fact that each study investigates a unique constellation of gain spiral parameters: studies differ in (1) the types of resources they analyze, (2) the additional variables that they relate the resources to, (3) the number of waves and the length of time-lags, and finally (4) the nationality and profession of the studied subjects.

As elaborated in the preceding chapter, gain spirals are reported between resources and work engagement (e.g., Weigl et al., 2010), team commitment (Le Blanc et al., 2010), marital satisfaction (Hakanen et al., 2011), respectively flow (Salanova et al., 2006), plus between different types of resources (Xanthopoulou et al., 2009), between team commitment and collaborative practice (Le Blanc et al., 2010), between work engagement and personal initiative (Hakanen et al., 2008), between work-family enrichment and work engagement (Hakanen et al., 2011), and between the affects of interacting individuals (Zimmermann et al., 2011). The range of different resources that have been considered includes (a) *work resources*

such as autonomy, social support, work relationships, opportunities for development, performance feedback, exchange with the superior, coaching, craftsmanship, pride in the profession, direct and long-term results, an orientation towards innovation, rules, and goals, and finally job, time, and method control; (b) *personal resources* such as self-efficacy, self-esteem, and optimism; and (c) *home resources* such as social support from friends and emotional, instrumental, respective appraisal support from family and partner.

Furthermore, study designs vary in the number of waves and the length of time intervals between waves. Although the majority of studies uses a two-wave design, there are also five-wave (Bakker & Bal, 2010), three-wave (Weigl et al., 2010) and even one-wave (Salanova et al., 2005) designs. Time-lags range from 60 minutes (Zimmermann et al., 2011) to one month (Bakker & Bal, 2010; Llorens et al., 2007), one year (Salanova et al., 2006; Schaufeli et al., 2009), two years (Le Blanc et al., 2010; Weigl et al., 2010; Xanthopoulou et al., 2009), and finally up to three years (Hakanen et al., 2011; Hakanen et al., 2008).

The generalizability of the studies is additionally enhanced by the diversity of subjects. With the exception of two student samples (Llorens et al., 2007; Salanova et al., 2005), subjects are employed in various professions including teachers (Bakker & Bal, 2010; Salanova et al., 2006), doctors (Hakanen et al., 2008; Weigl et al., 2010), nurses (Le Blanc et al., 2010), and employees of various ranks, functions, and industries (Schaufeli et al., 2009; Xanthopoulou et al., 2009; Zimmermann et al., 2011). Geographically, studies focus on Europe with an emphasis on the Netherlands (Bakker & Bal, 2010; Schaufeli et al., 2009; Xanthopoulou et al., 2009), Spain (Llorens et al., 2007; Salanova et al., 2006; Salanova et al., 2005), and Germany (Weigl et al., 2010; Zimmermann et al., 2011). One study even draws its subjects from eight different European countries (Le Blanc et al., 2010).

Finally, the studies need to be acknowledged for their practical relevance, which is partially thanks to the preference of naturalistic settings over laboratory studies. The studies concordantly point out that interventions designed to increase employees' resources may produce various positive effects (e.g., higher levels of work engagement, team commitment, or collaborative practice), which may even retroact on the employees' resources in a reciprocal fashion. For example, Weigl et al. (2010) emphasize that it should be in the best interest of an employer to design employees' work characteristics (i.e., work resources) in such a way that these have a reciprocal, self-sustaining effect on employees' work engagement. Of the same tenor, Le Blanc et al. (2010) stress that hospitals should design the working conditions of nurses to encourage for feelings of success and thus self-efficacy, since self-efficacy in turn positively impacts team commitment—and ultimately, high levels of team commitment is what increases the achievements of a hospital unit.

3.2.2   Limitations of the reviewed studies

Despite the contributions and strengths of the empirical studies, several major limitations need to be pointed out. These limitations may not be surprising, considering that this field of research is very novel and that these eleven studies represent the first empirical research ever carried out in this field. Nevertheless, acknowledging current limitations enables future research to systematically tackle and resolve these issues. The current limitations relate to the studies' interpretations of results, research designs, and methods, and can be grouped around five major themes: (1) there is no support for level-wise increases in resources over time, (2) the effect sizes are rather small, (3) resources are operationalized as key resources instead of broadly, (4) there is major uncertainty about the optimal time-lag between measurements, and (5) there are threats to internal validity.

No support for level-wise increases in resources over time

The major limitation of the studies is the fact that they provide evidence for reciprocal relationships, but not for gain spirals in the truest sense. In their theoretical work on COR gain spirals, Salanova et al. (2010) explicate that a relationship between two variables needs to fulfill two conditions in order to qualify as a "gain spiral" (see also Figure 3-1): first, the relationship must be reciprocal, i.e., the relation is both causal (A → B) and reversed causal (B → A); second, over time both variables are required to increase level-wise, such that AT2 > AT1 and BT2 > BT1. If the second condition is not fulfilled, it is possible to confirm a reciprocal relationship; it is, however, not possible to confirm a gain spiral.
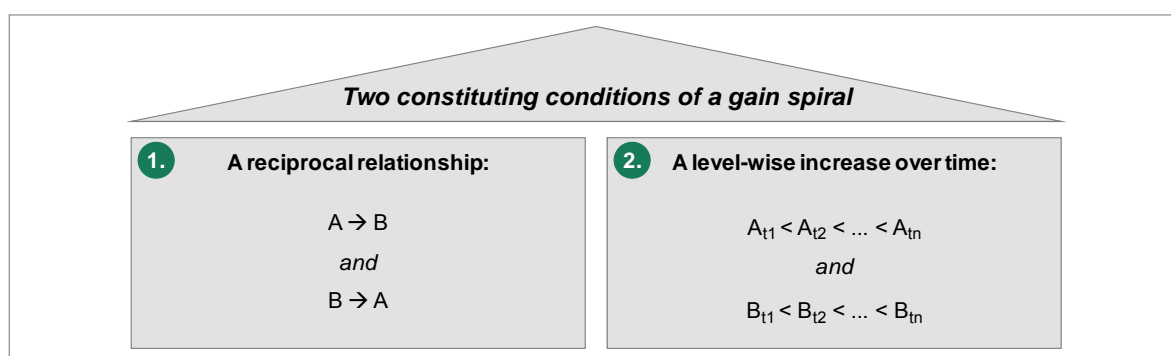
Figure 3-1   Two constituting conditions of a gain spiral (cf. Salanova et al., 2010)

Notably, none of the so-called "gain spirals" established within the eleven studies fulfill the second condition of level-wise increases over time; they only comply with the first condition of reciprocity. Hakanen et al. (2011), Weigl et al. (2010), and Xanthopoulou (2009) explicitly refer to this limitation, e.g.:

> "[…] it is crucial to note that there was no significant increase in the levels of resources and engagement over time. Therefore, even though our study supports the idea of cycles, it does not suggest that there are also, levelwise, gain cycles or spirals. Namely it cannot be deduced from our study that the occurrence of resources or engagement leads to higher levels of resources or engagement" (Xanthopoulou et al., 2009, p. 242)

The remaining eight studies fail to point out this severe limitation, and the respective data does not indicate level-wise increases over time. Hence—strictly speaking—no gain spiral has been empirically substantiated to date. The only existing empirical evidence is for reciprocal effects.

The most obvious reason for this lack of level-wise increases can be found in the research designs: all of the studies are non-experimental in the sense that they lack manipulations and systematic interventions. Inversely, systematic interventions designed to boost the resource levels of subjects in an experimental condition would increase the chances of observing level-wise increases in resources over time (Weigl et al., 2010; Xanthopoulou et al., 2009).

Overall small effect sizes

Another limitation of the existing studies relates to the rather small effect sizes reported. Effect sizes can be compared across studies based on the path coefficients included in the statistical models. Path coefficients represent a standardized measure for the effect of the predictor on the criterion: it corresponds to the standardized regression coefficient (β), which is an expression of the gradient of the regression function (Seibel & Nygreen, 1972). Thus, a ß value close to zero implies a weak relationship between predictor and criterion, while a value close to plus or minus one implies a strong relationship. The literature defines two alternative lower bounds for path coefficients to be considered meaningful: +/- 0.1 (Lohmöller, 1989, p. 60) respectively +/- 0.2 (Chin, 1998, p. 324). Taking a conservative approach following Chin (1998), the results of four of the eleven studies completely fall short of the lower bound for path coefficients of 0.2; their respective path coefficients range between 0.05 and 0.18 (Hakanen et al., 2011; Hakanen et al., 2008; Weigl et al., 2010; Zimmermann et al., 2011). Three other studies partially fall short of the defined lower bound, i.e., single paths fall below 0.2 (Bakker & Bal, 2010; Le

Blanc et al., 2010; Xanthopoulou et al., 2009); also see Figure 3-2. Weigl et al. (2010) and Hakanen et al. (2011) even openly challenge the practical relevance of their obtained results, e.g.: "all in all we must acknowledge that we had a large sample and that the effect sizes were small; consequently, the associations are more theoretically than practically significant" (Hakanen et al., 2011, p. 26).

Operationalization of resources as key resources

A major issue regarding resource operationalization in the eleven studies is that resources are represented by a few *key resources* rather than based on a very broad basis of resources. Each study focuses on between one and a maximum of eight resources; all studies combined cover a total of only 24 unique resources. This contradicts COR theory, which is based on the assumption of a wide variety of resources. In chapter 2.4, COR theory was explicitly defined as an *integrated resource theory* and thus differentiated from key resources theories that emphasize the importance of single resources. For the same reason, the COR evaluation scale is designed to cover 74 different resources (see chapter 2.1.3). Also, the 74 resources of the COR-E cover the four resource categories defined by COR theory (i.e., objects, conditions, personal characteristics, and energies), while the resources investigated in the eleven empirical studies are biased towards condition resources and personal characteristics resources. Resources from the objects category and especially from the energies category—which stand out for facilitating the acquisition of new resources (Hobfoll, 1989a)—are not considered by the studies. Above all, in this context the studies must be challenged for their failure to draw on the readily available COR evaluation scale for measuring resources. The COR-E was first published in 1992 (Hobfoll et al., 1992)—long before the first empirical studies on gain spirals were conducted—and is freely accessible on the internet (Hobfoll, 2007).

A related issue refers to the *additional variables* other than resources—such as work engagement, flow, or team commitment—that are investigated in the studies. For example, the most often studied gain spiral is that between work resources and work engagement. COR theory, however, postulates gain spirals between different resources, not between resources and other constructs. Certainly, this does not exclude the possibility of gain spirals between resources and other constructs such as work engagement; nonetheless it would be preferable to first establish gain spirals solely on the basis of resources. Based on this critical observation, two comments shall be made: one reconciliatory comment and one further critical comment. First *(reconciliatory)*, the additionally studied variables, such as work engagement, can be interpreted as resources themselves or combinations of resources. In the case of work engagement, this seems particularly feasible, since work engagement has generally been defined via the variables vigor, dedication, and absorption, which could be understood to be three resources. In the same vein, Gorgievski and Hobfoll (2008) propose that work engagement is a process involving "energetic resources" (p. 9). Yet none of the studies explicitly proposes this link between other constructs and resources. Second *(critical)*, most studies measure more than one resource and thus have the opportunity to probe gain spirals among multiple resources—but ignore this opportunity. By not evaluating the cross paths between different resources, the studies do not exhaust the potential insights on gain spirals. As an example, the study by Salanova et al. (2006) measures both work resources and personal resources, but in the structural equation model does not probe for reciprocal relationships between the two resource groups. Likewise, Bakker and Bal (2010) and Weigl et al. (2010)—who analyze work resources on the resource level, as opposed to the aggregate level—could have included the cross paths among the resources in their analyses. The only exceptions to this critique are the studies by Llorens et al. (2007) and Xanthopoulou

et al. (2009), who do analyze reciprocal relationships between work resources and personal resources.

Uncertainty about the optimal time-lag

Although the effect sizes have been compared across studies, the significance of such a comparison is reduced by the circumstance that the reported effect sizes refer to very distinct time intervals. The lag between two points of measurement varies among the studies, and ranges from several minutes (Zimmermann et al., 2011) to one week (Bakker & Bal, 2010) to up to three years (e.g., Hakanen et al., 2011). Figure 3-2 illustrates this issue by giving an overview of the path coefficients reported per study, arranging the studies according to their time-lags in ascending order.

The significant variation in the length of the time intervals between measurements is primarily a result of the lack of theoretical (or empirical) indications for determining the *optimal time-lag* when observing changes in resources levels (e.g., Hakanen et al., 2011; Hakanen et al., 2008). As a consequence, the different time-lags can mostly be ascribed to pragmatic considerations (e.g., Xanthopoulou et al., 2009). Some studies also refer to the work of Zapf, Dormann, and Frese (1996), who point out that "time lags that are *too short* may lead to the conclusion that no causal effects exist, whereas a time lag that is *too long* 'solely' leads to an underestimation of the true causal impact" (p. 158, emphases added). Possibly this explains why after all 75 percent of the studies chose a time-lag of at least eight months. Likewise, some studies refer to a longitudinal study conducted by Dormann and Zapf (2002), which suggests that a minimum time-lag of two years is required to observe causal effects between social stressors and depressive symptoms. Since gain spirals are assumed to show *less* momentum than loss spirals (Hobfoll, 1998), time-lags for the study of gain spirals should even exceed the two

year interval suggested by Dormann and Zapf (2002)—as reasoned, e.g., by Hakanen et al. (2011). However, this reasoning is not supported by the comparison of effect sizes as illustrated in Figure 3-2: the two studies featuring a time-lag of three years report particularly small path coefficients.
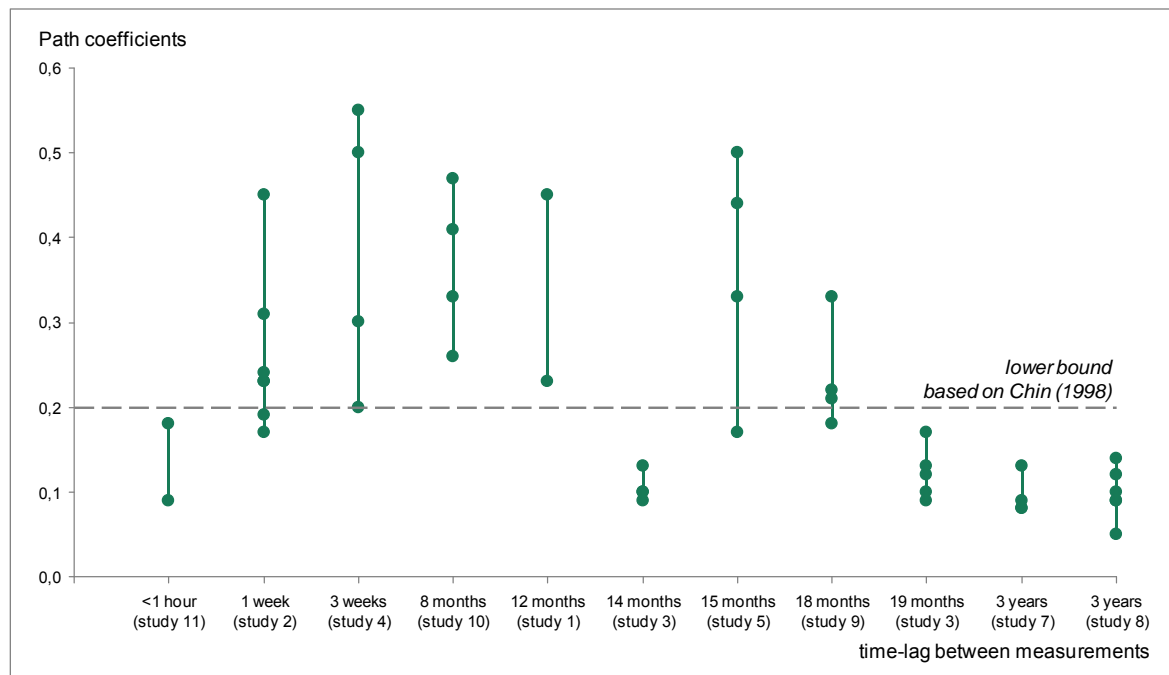
Figure 3-2   Studies' reported path coefficients, ordered by time-lag

However, it is not possible to infer indications for an optimal time-lag from Figure 3-2 (or from the data obtained in the eleven empirical studies). As discussed in chapter 3.2.1, each study investigates a unique constellation of resources and additional variables. As Hakanen et al. (2008) point out, the optimal time-lag might depend on the quality of the investigated resource: "it could be that an adequate time-lag for the effect from job resources to work engagement to occur may be different to the time period required for PI [personal initiative] to influence innovativeness in work-units" (p. 89). Furthermore, it is conceivable that the optimal time-lag might additionally depend on the direction of causality (causal versus reversed causal), so that there might be two different optimal time-lags for one

single resource, depending on the direction of the effect at hand. For example, Weigl et al. (2010) ponder that "for work engagement to affect environmental features might actually require a longer timeline than for the environment to affect engagement. Job characteristics and social relationships tend to be somewhat inert and typically cannot be changed at short notice" (p. 149). Overall, there is no clear evidence regarding the optimal time-lag that should be implemented in studies in order to best observe reciprocal effects between resources .

Threats to internal validity

Another consequence of the non-experimental designs is that the resulting relationships are correlational, but not necessarily causal. As a result, a possible influence of third variables cannot be ruled out; for example, the observed effect of variable A in T1 on variable B in T2 may also be the outcome of an unmeasured third variable C (e.g., Xanthopoulou et al., 2009). This aspect of the studies poses a serious threat to their internal validity.

A second threat to internal validity lies in the repeated measurements of resources: the initial measurement may have sensitized subjects towards the existence of resources or may have encouraged selective perception. Thus, instead of actually building resources, subjects could have merely increased their *perceptions* of resources (e.g., Schaufeli et al., 2009). Within the reviewed studies, such an effect cannot be ruled out as alternative explanation.

Furthermore, all observations are based on the subjects' self-reports. However, a mono-method design involves the risk of large common method variance and thus a systematic bias of the results (e.g., Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). In this sense it is conceivable that the self-reports were influenced by, e.g., consistency motives or the subjects' implicit theories. Employing multiple methods

would be a way to control the method variance, and at the same time control the above-mentioned issue of selective perceptions. Since this is not undertaken in the reviewed studies, there remains a risk that the observed relationships are artificial or artificially inflated—which poses another threat to internal validity.

3.3 Implications for future research: A research agenda for gain spirals

As discussed in the previous chapter, gain spirals have, strictly speaking, not yet been empirically proven. Although most studies conclude that they found evidence for gain spirals, the data only supports the first condition for gain spirals, i.e., reciprocal relationships, but not the second condition for gain spirals, i.e., level-wise increase over time. Hence the most pressing issue for future research is a foundational one: to solidly confirm the existence of resource gain spirals. In order to fill this need for a solid empirical confirmation, future research needs to (a) induce level-wise increases over time, (b) eliminate the currently existing threats to internal validity, and (c) more clearly account for the fact that COR theory postulates a broad array of resources rather than few key resources. Once gain spirals are empirically substantiated, additional details about the effectiveness of gain spirals can be investigated. Open issues include questions regarding the period of latency between resource interventions and resource increases (i.e., the question of the optimal time-lag) and the question of whether resources spill over between domains (e.g., are there gain spirals between work resources and personal resources?). Clarifying these details is important in order to increase the practical relevance of gain spirals: these considerations are fundamental to the effective design of interventions for the praxis. Consequently, a two-tiered research agenda is outlined in the following. Tier one is comprised of the empirical confirmation of gain spirals and tier two of the clarification of details that are relevant for the implementation of gain spirals in praxis.

Tier one: Substantiating gain spirals

Above, three requirements have been defined for the solid empirical foundation of gain spirals. First, the second condition of gain spirals (as defined by Salanova et al., 2010) needs to be fulfilled by substantiating level-wise increases in resources over time. For this purpose, future empirical studies need to include interventions that allow for the systematic manipulation of subjects' resources (e.g., suggested by Weigl et al., 2010). The reasoning for this is that an initial intervention increasing one or more resources is likely to entail an increase of the overall resource level over time. Given this result, the second condition for gain spirals would be met for the first time.

R	X	O1	O2	O3	O4	
		O5	O6	O7	O8	X

Figure 3-3   Experimental research design including a waiting-list control

In addition to including systematic interventions, future studies should also strive to account for the additional requirements of experimental studies. Specifically, researchers should introduce control group designs into gain spiral research, administering a control group that is studied under the same conditions as the experimental group but which does not receive the resource intervention. The control group could be—but need not be—a waiting-list control group. However, the subjects' allocation to experimental versus control group should be performed in a randomized fashion (see Figure 3-3). An additional benefit of adhering to these principles of experimental research design is that it allows the causal interpretation of research results. A causal interpretation of the results of the eleven existing studies is not possible, since they only account for correlational relationships.

Second, an improved study design needs to remove the threats to internal validity mentioned above. In the previous chapter, two possibly confounding effects were identified: common method bias and selective perception. Systematic bias caused by the use of a single measurement instrument can be eliminated by using multiple measures, i.e., a mixed methods design. In the context of resource gain spirals, other measures in addition to self-reports could include, e.g., reports of associated individuals, such as partners or supervisors, or objective data such as cortisol levels, sickness absenteeism, promotions, or available income. The inclusion of objective data could also prevent the potential bias caused by increasing the awareness of resources. Alternatively, researchers could use a control group design, in which the control group is equally sensitized towards their resources as the experimental group—e.g., by means of lectures that increase the awareness of resources, but are not designed to increase resource levels. A possible effect of increased resource awareness could then be ruled out as an alternative explanation for significant differences between the experimental group and control group.

Third, future studies should better reflect the fundamental assumption of COR theory that resources are manifold and complexly interrelated. COR theory was explicitly developed as an integrated resource theory rather than a key resource theory (refer to chapter 2.4). Thus, instead of continuing to measure key resources, studies should ideally utilize the readily available COR evaluation scale (see chapter 2.1.3). At the very least, future studies should survey a broader range and larger number of resources.

Tier two: Clarifying details on the effectiveness of gain spirals

Once the existence of gain spirals has been empirically substantiated, additional research can shed light on *how* gain spirals take effect. The aim of the second tier of the research design is to provide a basis for the design of effective interventions. In

the following, a number of open questions regarding the precise mode of effectiveness of gain spirals are discussed. Notably, these questions should not be considered exhaustive; it is more likely that future research and first application scenarios will lead to further questions to be investigated.

The first question regards the shape of gain spirals, i.e., the *curve progression* of resource gains over time. In chapter 2.5, four generic types of curve progressions were discussed: (1) a *linear* progression, in which resource gains (once initiated) advance at the same rate; (2) an *exponential* progression, in which resource gains progress at an increasing rate; (3) an *asymptotic* progression, in which resource gains proceed at a decreasing rate and gradually approximate a maximum resource level; and (4) a *parabolic* progression, in which resource gains advance at a decreasing rate up to a point where they turn into resource losses. It was also pointed out that Hobfoll's theoretical works implicitly suggest an exponential progression, although both intuitive and theory-based thinking suggest that—at least for some resources—an asymptotical progression appears more plausible than an exponential progression. Thus, it might not be the case that one single curve progression is true for all resources; rather, a *differential perspective* may be more appropriate. In view of effective interventions in praxis it is crucial to impede parabolic resource progressions—either by empirically ruling out their existence or by identifying and avoiding the genesis conditions of such parabolic progressions. A parabolic resource progression could occur when the gain of one resource involves the loss of other resources; in the same spirit, Hobfoll (2002) discusses the question "can there be too much of a good thing?" (p. 316). In conclusion, future empirical studies should systematically determine—on the basis of single resources—the respective curve progressions of gain spirals. This goal requires longitudinal studies with at least three waves; otherwise, linear, exponential, and asymptotical progressions are impossible to tell apart.

The second question pertains to the possibility of *spillover effects* of gain spirals between different domains of life. In other words, can a resource gain spiral that was initiated in the leisure domain—e.g., by engaging in a fulfilling hobby—also extend to the work domain and demonstrate positive effects, e.g., on work engagement? Or is it rather the case that resource gain spirals in one life domain occur at the expense of resources in other life domains? Clarifying this question is also very relevant for the design of practical interventions. If future research did establish positive spillover effects between life domains, practical interventions might take very different form. For example, burnout prevention would then not be limited to improving the work situation, but might also include prevention in the off-work/private domain (e.g., Sonnentag, 2005). A lot of research on different types of spillover scenarios already exists in the context of role theory, particularly at the work-family interface (e.g., Edwards & Rothbard, 2000; Geurts & Demerouti, 2003; Greenhaus & Powell, 2006; Wayne, Grzywacz, Carlson, & Kacmar, 2007). Future COR theory research could use these insights to shed light on possible spillover effects in the context of resource gain spirals.

R	X	O1	O2		O3
	X	O4		O5	O6
	X		O7	O8	O9
	X	O10		O11	O12
	X		O13	O14	O15
	X		O16	O17	O18
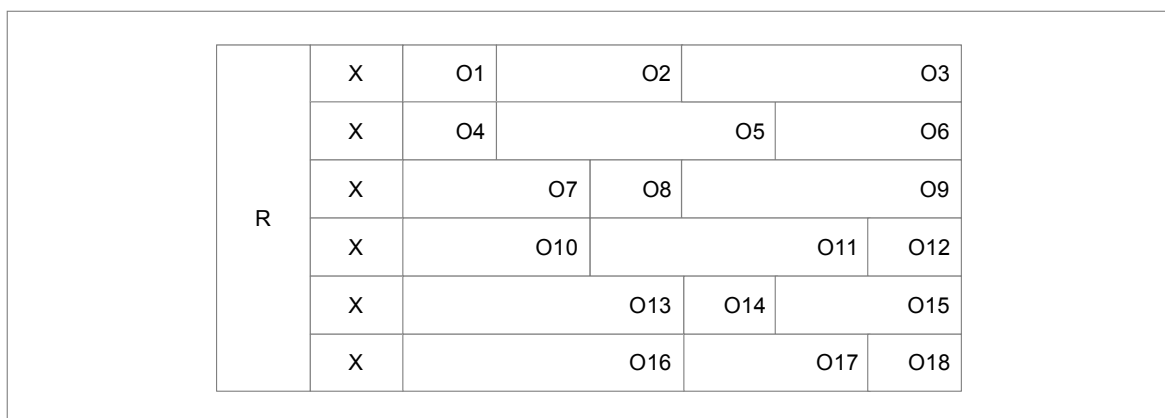
Figure 3-4   Systematic variation of time-lags between measurements

The third practically relevant question concerns the *latency time* between a resource intervention and the initiation of the respective gain spiral. The relevance

of this question for research—in terms of the optimal time-lag between two points of measurement—has already been discussed in the previous chapter. It is, however, also highly relevant for praxis, e.g., when establishing the time-lag after which the effectiveness of a resource intervention should be evaluated. In order to answer this question, a research design that systematically varies the time-lags between measurements is suggested (see the example in Figure 3-4). Weigl et al. (2010) propose sliding time-lags of e.g., six, twelve and 18 months.

The fourth question considers *qualitative distinctions among resources*. Although COR theory does not include the concept of single key resources, it is generally conceivable that some resources are more effective in initiating gain spirals than others. It could also be the case that for specific application scenarios some resources are most effective, while for other application scenarios, other resources are most effective. To develop an answer to this question, researchers should use an experimental design that systematically varies which resources are manipulated. This design also allows researchers to simultaneously test whether the intervention of several resources is superior to the manipulation of single resources (see the example in Figure 3-5).

	X_1	O1	O2	O3	O4	
	X_2	O5	O6	O7	O8	
R	X_3	O9	O10	O11	O12	
	$X_{1,2,3}$	O13	O14	O15	O16	
		O17	O18	O19	O20	X

Figure 3-5   **Systematic variation of resource interventions**

Additionally, a study by Diener and Fujita (1995) suggests that the relationship between the resources available to an individual and his or her subjective well-

being is strongest when these resources are essential for the individual's personal goals. Thus it is even possible that the very same resources are differently effective in initiating gain spirals of different individuals. Exploring the role of such an idiographic perspective on resources is therefore an additional facet of understanding the qualitative differences among resources.

4 Research approach

4.1 Accounting for the limitations of current gain spiral research

To further develop the empirical foundation of gain spirals, new studies should account for the limitations of current studies and follow the resultant guidelines for future research. Based on the current limitations discussed in chapter 3.2.2, chapter 3.3 elaborated a two-tiered research agenda, which is summarized in Figure 4-1.
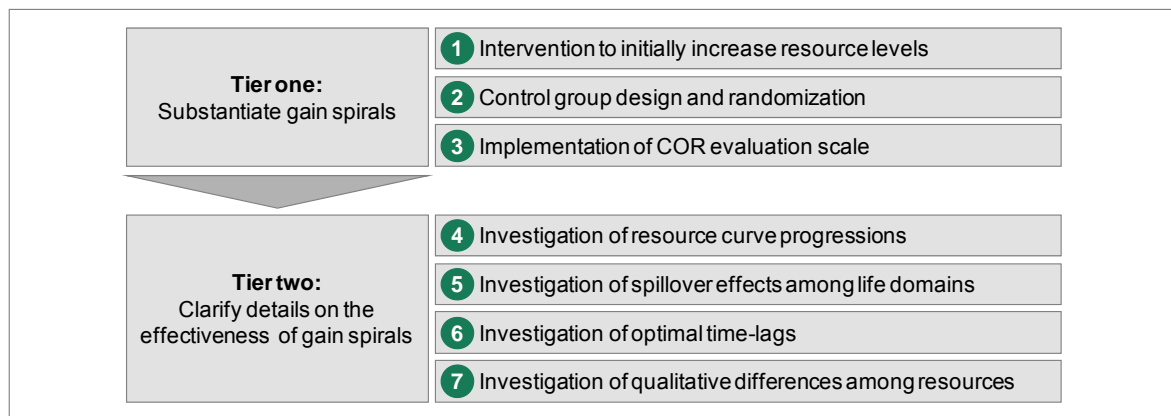
Figure 4-1   Gain spiral research agenda

The first requirement of the research agenda is that future gain spiral research needs to implement *interventions* that cause an initial increase in resource levels, in order to observer level-wise resource gains over time. Thus, the challenge is to identify an intervention that shows a powerful and manifold effect on subjects' resources. At the same time, the intervention needs to be practicable as well as cost and time efficient. The research conducted in this study draws on *physical activity* (i.e., sports and exercise) as an effective and extensive resource intervention. Chapter 4.2 describes the manifold positive effects of physical activity—both from an objective and subjective perspective—and finally hypothesizes which of the resources suggested by COR theory are directly affected by physical activity. Nota-

bly, in order for such an intervention to cause *initial* gains in resources, it is necessary to look at individuals who have only recently started a physical activity program, and who were previously inactive.

The second requirement is to use an experimental design that includes a control group and randomization. Hence, the design must comprise both an experimental group who are new to physical activity and a control group of permanently physically inactive subjects. The control group is required as a baseline for comparison against the resource gains of the experimental group. Optionally, an additional control group of subjects who have been continuously physically active and/or subjects whose degree of physical activity varies over time could be included. Randomization, however, will not be accounted for in the research conducted in this thesis. For three reasons, the research relies on subjects who independently decided to newly participate in physical activity and thus self-selected themselves in the experimental group: first, there may be higher resource gains if subjects enjoy physical activity and thus voluntarily decide to be physically active; second, for the same reasons, injuries and other risks associated with physical activity may be lower; third, it is the easiest and most efficient approach from a practical point of view.

The third requirement concerns the implementation of the COR-E (see chapter 2.1.3). Since the COR-E is readily available online (Hobfoll, 2007), this is just a matter of translating the COR-E into German (which has not been previously done) and using it to measure subjects' resource gains and losses. However, this requirement prohibits the use of already existing datasets from well-designed longitudinal studies, such as the German Socio-Economic Panel Study (SOEP) (for a description of the SOEP see Wagner, Frick, & Schupp, 2007; Wagner, Göbel, Krause, Pischner, & Sieber, 2008). A compromise might be to use both (1) a newly developed study implementing the COR-E and (2) the dataset of the SOEP, which

features a sound longitudinal design and a large sample, but requires approximating resources. Specifically, it is suggested to use measures of subjective well-being—which the SOEP has prominently featured since its beginning in 1984—as a proxy for individuals' overall resource levels. Therefore, the relationship between subjective well-being and resources is elaborated upon in chapter 4.3.

The fourth requirement relates to the question of gain spiral curve progressions and thus necessitates longitudinal studies of at least three measurements. While this is just a matter of research design and implementation, several challenges are associated with longitudinal studies. The most prominent issues concern the acquisition of subjects, who often shy away from the effort of multiple measurements, and the gradual dropout of subjects over time. Thus, in order to still have a meaningful number of subjects remaining in the last wave of the study, a considerably larger number of subjects need to be acquired for the first wave. As indicated above, these issues may be reduced by (additionally) drawing on professional longitudinal research such as the SOEP dataset.

Requirement five aims to develop an understanding of potential spillover effects among different life domains. Typically, spillover effects are discussed as existing between the work domain and the leisure or home domain. Two key reasons make it interesting and necessary to investigate the existence and mechanisms of such spillover effects. First, it is necessary to rule out potentially negative spillover of a resource intervention in one life domain into another life domain—e.g., a resource intervention in the leisure domain may not have a negative impact on the work domain. Second, it would be valuable to establish whether positive spillover processes among life domains exist—e.g., if a resource intervention in the leisure domain might have a positive impact on the work domain—and under which conditions these take effect. However, empirical testing of these effects is only secondary to empirically establishing the existence of resource gain spirals, and is thus

not included in the scope of this thesis. Still, chapter 8 will make an argument for including spillover effects in future gain spiral research.

Requirements six and seven refer to the following questions, respectively: what is the optimal time-lag between two measurements of resources, and are there qualitative differences among resources? The investigation of these questions requires separate studies that *ceteris paribus* systematically vary the time-lags and the manipulated resources. These questions are therefore not in the scope of this thesis.

From the four requirements which are included in scope of this thesis, the specific *predictions* for the empirical investigation will be deduced in chapter 4.4. As a preceding step, chapter 4.2 discusses *physical activity* as a resource intervention, since participating in physical activity will represent the independent variable in the successive empirical studies. Chapter 4.3 discusses the current state of knowledge on *subjective well-being* and elaborates on why and how subjective well-being may serve as a proxy for estimating an individual's level of resources. In the following empirical studies, resources will represent the dependent variable and will be measured both in terms of the COR-E and subjective well-being.

4.2   Physical activity as resource intervention

Physical activity is an obvious choice for an intervention that causes a large effect on an individual's resources. It is both common and scientific knowledge that physical activity produces numerous positive effects on a wide range of resources. The key confirmed empirical evidence for the effects of physical activity on the improvement of psychological and physiological well-being will be outlined in chapter 4.2.1. Asides the evidence for psychological and physiological effects, most individuals report participating in physical activity "because it's fun" or for motives such as challenge, affiliation, or social recognition. Therefore, chapter 4.2.2

takes a more subjective approach to resources that may be enhanced by physical activity and examines the generally reported motives for activity. Overall, the vast range of objectively measurable and subjectively perceived benefits makes physical activity a very powerful intervention. Finally, based on the list of resources proposed by the COR evaluation scale, a hypothesis is presented regarding which COR-specific resources are likely to benefit from an individual's engagement in physical activity (chapter 4.2.3).

However, before examining physical activity as a versatile resource intervention, some terminological clarifications are required. The term *physical activity* is "an umbrella term describing any bodily movement produced by the skeletal muscles resulting in energy expenditure" (Fox, Boutcher, Faulkner, & Biddle, 2000, p. 8). These bodily movements may occur in the context of either (a) sports, (b) exercise, or (c) lifestyle physical activity (also refer to Figure 4-2).
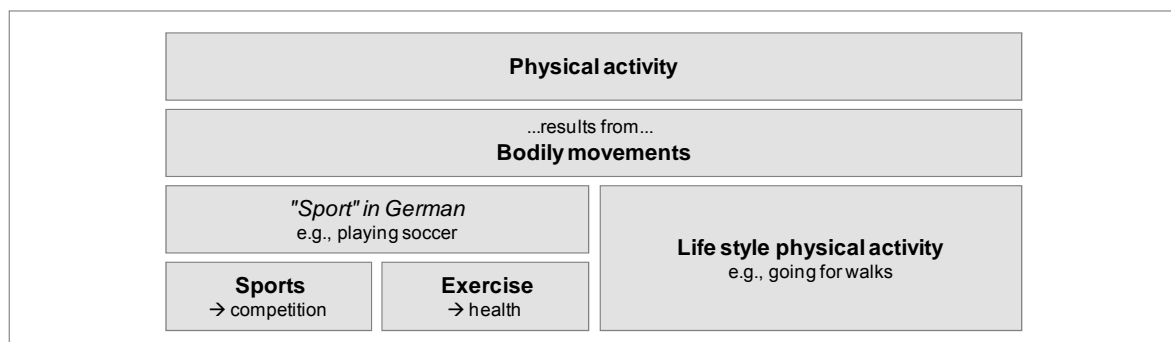
Figure 4-2   Taxonomy of physical activity based on Brand (2010, p. 13)

Sport is defined as "physical activity that involves structured competitive situations governed by rules" (Fox et al., 2000, p. 8); i.e., there is a clear focus on achievement and competition. Exercise, on the other hand, is defined as "a subset of physical activity that is volitional, planned, structured, repetitive and aimed at improvement or maintenance of an aspect of fitness or health" (Fox et al., 2000, p. 7). Exercise thus has clear focus on health aspects. Notably, the usage of the term

"*sport*" in German (and in mainland Europe in general) deviates from the above definition of the term "sport". In Germany, the term is generally used in a wider context, including both competition-focused and health-focused physical activities (Fox et al., 2000, p. 8). Finally, *lifestyle physical activity* refers to physical activity as part of the daily routine, such as walking, riding a bike, or taking the stairs instead of the elevator (Brand, 2010).

In the following, the focus is on any of the three classes of physical activity. This is especially the case, since the empirical evidence for the positive impact of different modes of activity is still inconsistent (e.g., Brand, 2010). More important than the specific type of physical activity seem to be the levels of intensity, duration, and frequency: e.g., for a positive effect on physical health it is recommended for adults to achieve 30 minutes or more of moderate-intensity physical activity on three to four—preferably all—days of the week (Pate et al., 1995).

4.2.1 Objective lens: empirical evidence for the effects of physical activity on psychological and physiological well-being

There is extensive empirical research on the positive effects of physical activity on various aspects of psychological and physiological health. These effects are supported by substantial bodies of evidence and consistent findings, often verified by meta-analytic reviews. In the following, the key substantiated effects of physical activity on (1) mood and emotion, (2) anxiety, (3) clinically defined depression, (4) self-esteem and self-perceptions, (5) cognitive performance, and (6) physical health will be summarized. These effects include preventive, curative, and rehabilitative functions of physical activity. Notably, although the evidence on the existence of these effects is rather solid, there is still little knowledge about the processes and variables mediating these effects.

Mood and emotion

Overall, the empirical evidence supports a positive effect of physical activity on mood and emotion. Evidence has been found for both *acute effects*, i.e., short-term benefits immediately following a single session of physical activity, and for *chronic effects*, i.e., longer-term benefits resulting from involvement in physical activity over time (Biddle, 2000; Plante & Rodin, 1990). In order to determine subjects' emotions, most research relies on measures of global affect, e.g., Watson and Tellegen's (1985) positive affect and negative affect scale, or Russell's (1980) circumplex model (Biddle, 2000). In an extensive review of empirical evidence, Biddle (2000) finds that physical activity is consistently associated with an increase in *positive affect*. Additionally, he establishes moderate-to-high correlations between (a) task orientation in exercise respectively (b) task climate in exercise situations and positive affect.

Mood, on the other hand, is typically measured based on the Profile of Mood States or the Multiple Affect Adjective Check List (Biddle, 2000). Findings are thus restricted to the specific dimensions included in the measurement instruments. Both Biddle (2000) and Plante and Rodin (1990) report consistent evidence that physical activity improves vigor and exhilaration, while resulting in reduced tension, (sub-clinical) depression, fatigue, anger, and confusion. Additional reductive effects on anxiety are discussed separately.

Based on an extensive literature research, Plante and Rodin (1990) have collated theories attempting to explain the positive effects of exercise on psychological health and well-being, including mood and emotion; these are summarized in Figure 4-3. The authors distinguish between biological and psychological theories, finding that biological mechanisms alone are not sufficient to explain the effects of activity. For example, different types of exercise (aerobic and anaerobic) achieve

similar psychological gains, and psychological gains are differently associated with perceived relative to actual fitness (Plante & Rodin, 1990).

Biological mechanisms	Psychological mechanisms
1. Increases in *body temperature* due to exercise result in short-term tranquilizing effects 2. Regular exercise facilitates stress adaptation because the increase in *adrenal activity* resulting from regular exercise increases steroid reserves which are then available to counter stress 3. Reduction in resting muscle activity potential following exercise causes *tension release* 4. Exercise enhances the *neurotransmission* of norepinephrine, serotonin, and dopamine 5. Exercise causes the release of endogenous *morphine-like chemicals* (i.e., endorphins and enkephalins) synthesized in the pituitary gland	1. Improved physical fitness provides people with a sense of *mastery, control, and self-efficacy* 2. Exercise is a form of meditation that triggers an altered and more *relaxed state of consciousness* 3. Exercise is a form of *biofeedback* which teaches exercisers to regulate their own autonomic arousal 4. Exercise provides *distraction, diversion, or time out* from unpleasant cognitions, emotions, and behaviors 5. Exercise results in the physical symptoms associated with anxiety and stress (e.g., sweating, hyperventilation, fatigue) without the subjective experience of emotional distress; *repeated pairing of the symptoms* in the absence of associated distress results in improved psychological functioning 6. The substantial *social reinforcement* afforded by exercisers leads to improved psychological states 7. Exercise may act as a *buffer*, resulting in decreased strain caused by stressful life events 8. Exercise *competes with negative affects*, such as anxiety and depression, in the somatic and cognitive systems (system view)

Figure 4-3   Possible mechanisms to explain the effects of exercise on psychological health and well-being (based on Plante & Rodin, 1990)

Anxiety

Anxiety describes an unpleasant emotional state generally related to the experience of threat or stress (e.g., Spielberger, 1972). Since stress-related disorders are a growing concern, the reduction of anxiety in response to stressful events has become an end in itself. The empirical evidence for the anxiety-reducing effects of physical activity is well advanced. A number of randomized control studies, as well as reviews of studies, have been performed. In a meta-analytic study, Taylor (2000) reviewed these extensive findings. Generally, studies investigate the effect of physical activity—both acute and chronic—on three anxiety-related dependent variables: (1) state anxiety, (2) trait anxiety, and (3) psycho-physiological reactivity, e.g., blood pressure or heart rate, to a subsequent psychosocial stressor.

Overall, research consistently finds a low-to-moderate anxiety-reduction effect of physical activity. First, there is evidence for a reductive effect of single sessions of physical activity on *state anxiety*. This effect appears to be greatest when the exercise type is aerobic and rhythmic. Second, there is support for a reductive effect of longer-term physical activity on *trait anxiety*. This effect has been substantiated for a wide range of sub-groups in the population, in clinical and non-clinical settings, and for both men and women. The effect appears to be greatest when the duration of the physical activity training is at least ten weeks. Third, single sessions of moderate physical activity have been shown to reduce *physiological reactivity* in terms of to a subsequent psychosocial stressor—e.g., a public speech or a Stroop test—and to enhance *recovery* from the psychosocial stressor.

The mechanisms believed to underlie the acute effect of single sessions of physical activity on anxiety are largely identical to the mechanisms hypothesized to be at work in the context of physical activity and mood (see Figure 4-3). An additionally proposed mechanism is the time-out or distraction hypothesis, which suggests that any distracting activity may result in short-term reductions of state anxiety (Taylor, 2000). The mechanisms hypothesized to mediate the chronic effect of longer-term physical activity on anxiety include the development of more positive affect and cognitions, the development of enhanced coping resources and social networks, and an improved physical health status which (a) enhances health-related quality of life and (b) reduces fear and anxiety related to ageing (Taylor, 2000).

Clinically defined depression

The effects of physical activity on clinically defined depression are particularly impressive. There is conclusive evidence that physical activity is effective in both (1) decreasing the risk of developing clinically defined depression and (2) treating

clinically defined depression. Regarding the *preventive effect* of physical activity, Fox (1999) found that prospective epidemiological studies substantiate a 28% reduction in the risk of developing clinically defined depression when physically active (for men engaged in high activity over a 23-37 year period compared to those low in activity) and, conversely, increased odd ratios when not physically active. Regarding the curative effect of physical activity, Mutrie (2000), in her meta-analytic review, states that the evidence is strong enough to support a causal link between physical activity and reduced clinically defined depression. Based on several randomized control studies, she finds that aerobic and resistance exercise, usually in addition to standard treatment, are especially effective in treating depression. Moreover, the effect has the same magnitude as psychotherapeutic interventions. Another meta-analytic review reports an overall mean effect size of -0.72 (Craft & Landers, 1998).

Despite strong evidence for the effect of physical activity on clinically defined depression, the underlying mechanisms are not yet known. Hypothesized mechanisms are generally identical with the mechanism proposed for the effect of physical activity on psychological well-being in general (see Figure 4-3). The most prominently suggested explanations concern biochemical processes such as increased levels of endorphins and psychological mechanisms such as an increased sense of mastery (Mutrie, 2000).

Self-esteem and self-perceptions

Self-esteem and related self-perceptions are in themselves critical indicators of mental health. Fox (2000) conducted an extensive review of existing randomized control studies on the effects of physical activity on self-esteem and self-perceptions. Overall, he finds evidence for a positive effect of physical activity on self-esteem in terms of *physical self-perceptions*. Physical self-perceptions include

body image and perceived physical self-worth; the latter has been shown to have an independent effect on aspects of mental well-being and can in itself be considered a valuable outcome of physical activity (Fox, 2000). The relationship between physical activity and physical self-perceptions has been established for both men and women, and found to be strongest for children and middle-aged adults. The positive effect on physical self-perceptions has been shown to be strongest for individuals with initially low levels of self-esteem. In some situations, the improvement in self-perceptions is accompanied by increased self-esteem. Generally, however, findings on the effects of physical activity on *generalized self-esteem* are mixed, since self-esteem is a relatively stable construct (Fox, 2000). In addition, the mechanisms underlying the effects of exercise on self-esteem and related self-perceptions are not yet fully explained. Potential explanations include perceived improvements to the body (e.g., fitness or weight loss), feelings of autonomy and personal control, and a sense of social belonging and significance (Fox, 2000).

Cognitive performance

Overall, empirical studies support a positive effect of physical activity on cognitive functioning. A meta study by Etnier et al. (1997) finds a small positive effect size of 0.25 across various exercise paradigms, participants, and cognitive tests. There is, however, uncertainty about the physiological and psychological variables that mediate this effect (Etnier, Nowell, Landers, & Sibley, 2006). Potential mechanisms that have been identified include cerebral circulation, neurotrophic stimulation, neural efficiency, secondary ageing, and psychosocial mechanisms (Boutcher, 2000).

Additionally, much of the existing research focuses on the effect of physical activity on cognitive functioning of *older adults*. Cross-sectional studies show that fit older adults exhibit better cognitive functioning than less fit older adults

(Boutcher, 2000). This relationship is strongest for cognitive tasks that are attention-demanding and rapid (Boutcher, 2000); there are findings for, e.g., reaction times, movement times, and memory-search performance (Plante & Rodin, 1990). Moreover, meta-analytic findings on intervention studies suggest a small but significant increase in cognitive performance of elderly subjects who increased their aerobic fitness (Boutcher, 2000).

Physical health

Physical activity reduces the risk of several diseases and thus primarily performs a *preventive function*. In addition, physical activity may help to reduce the immediate and long-term consequences of already existent physical illnesses and, as such, may also take on a secondary *curative and rehabilitative function* (Lippke & Vögele, 2006). These preventive, curative, and rehabilitative functions apply to a wide range of aspects of physical health (for an extensive discussion see Dishman, Washburn, & Heath, 2004).

First of all, physical activity helps to build *fitness*, e.g., high levels of cardiovascular performance (Lippke & Vögele, 2006). Second, physical activity strengthens the defense mechanisms of the *immune system* (e.g., Dishman et al., 2004); as Lippke and Vögele (2006) point out, this is even the case when the immune system is already weakened by the HIV infection. Third, physical activity has been found to be an important contributor to overcoming *overweight and obesity* (e.g., Melzer, Kayser, & Pichard, 2004), which, if untreated, may result in a number of additional physical problems including increased cardiovascular risks and mortality (e.g., Wei et al., 1999). Fourthly, physical activity has an impact on genetic risk factors such as *hypertension* and *hyperlipidemia* by lowering blood pressure and improving the blood lipid profile (Dishman et al., 2004; Melzer et al., 2004). In addition, physical activity has been shown to have an effect on *diabetes*, reducing both the risk of

developing diabetes in the first place and the risk of developing diabetes-specific secondary damages (e.g., Sigal, Kenny, Wasserman, & Castaneda-Sceppa, 2004). Next, there is a confirmed positive effect of physical activity on *bone development and bone density* (e.g., Krall & Dawson-Hughes, 1994), a preventive effect regarding the development of *osteoporosis* (e.g., Dishman et al., 2004), and a preventive and curative effect on *back pain* (e.g., Lippke & Vögele, 2006).

Moreover, physical activity has been established as having a preventive and curative impact on the development of several types of *cancer* (see Dishman et al., 2004); it is a protective factor for the growth of tumors and helps former tumor patients to improve their health and reduce secondary damages (Lippke & Vögele, 2006). Finally, physical activity has a confirmed positive effect on life expectancy, i.e., physical activity reduces *all-cause mortality* and mortality related to several specific diseases, especially *cardiovascular disease mortality* and *coronary heart disease mortality* (Dishman et al., 2004; Melzer et al., 2004).

Nevertheless, there is also evidence for a number of *risks of physical activity*, including hazards for physical health, such as injuries, dehydration, or cardiac arrest (e.g., Dishman et al., 2004; Melzer et al., 2004) and psychological health, such as exercise dependence or eating disorders (e.g., Szabo, 2000). However, there is evidence indicating that when practiced in the range generally recommended by public health guidelines, physical activity exhibits an acceptable ratio of health risks to health benefits (Melzer et al., 2004). The World Health Organization (2002) suggests a good risk-to-benefit ratio for every-day non-competitive physical activities (compare Figure 4-4).
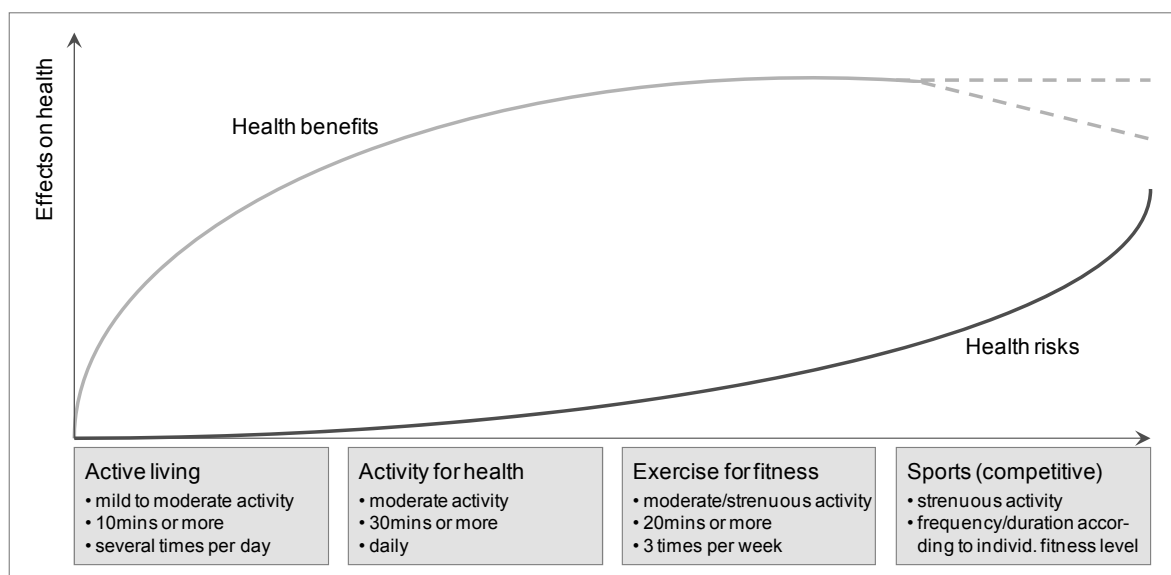
Figure 4-4   Positive and negative effects of physical activity on health (WHO, 2002)

On a concluding note, reference is made to Fox et al. (2000), who provide a convincing argument for the wide range of substantial benefits associated with physical activity:

> "First, exercise is cheap. Second, exercise carries negligible deleterious side-effects. Third, exercise can be self-sustaining in that it can be maintained by the individual once the basic skills have been learnt […]. Fourth, given that many common non-drug treatments, such as cognitive behavioural therapy, can be expensive and often in short supply […], there is much to commend other strategies […]. Finally, given the inherent physical benefits, exercise should be promoted regardless of any impact on mental health." (p. 4f)

4.2.2   Subjective lens: Individual motives for participating in physical activity

Another way of determining which kinds of resources are strengthened through physical activity is to look at the subjective reasons individual cite for participating in regular physical activity. For the purpose of understanding these individual motivations, Markland and Hardy (1993) developed the Exercise Motivations Inventory (EMI), which was later revised into the EMI-2 (Markland & Ingledew, 1997). The subscales of the original EMI were generated based on an open-ended

questionnaire, followed by a principal components analysis on the data of 249 regular exercisers (Markland & Hardy, 1993). During the revision of the EMI, two subscales were added, creating the EMI-2 with 14 subscales (Markland & Ingledew, 1997).

The first group of subscales relates to *psychological motives* for participating in physical activity, namely stress management (e.g., "because it helps to reduce tension"), revitalization (e.g., "to recharge my batteries"), enjoyment (e.g., "because I enjoy the feeling of exerting myself"), and challenge (e.g., "to give me goals to work towards"). The second group relates to *bodily and fitness reasons*, comprising strength and endurance (e.g., "to develop my muscles"), nimbleness (e.g., "to maintain flexibility"), weight management (e.g., "to stay slim"), and appearance (e.g., "to help me look better"). A third group of motives concerns *health aspects* including health pressures (e.g., "because my doctor advised me to exercise"), ill-health avoidance (e.g., "to prevent health problems"), and positive health (e.g., "because I want to maintain good health"). A final group of motives covers *social facets* of physical activity, namely social recognition (e.g., "to gain recognition for my accomplishments"), affiliation (e.g., "to spend time with friends"), and competition (e.g., "because I like trying to win in physical activities"). All items quoted in brackets as exemplary items are taken from the EMI-2 as available via Markland (2011).

These fourteen motives can be directly thought of as resources in terms of COR theory. They either represent personal resources such as enjoyment and challenge, or conditions such as health or spending enough time with friends. The ranking order of these motives is not established and likely depends heavily on the characteristics of subjects—such as age, sex and type of physical activity performed. However, revitalization, fitness, and weight management range among the top six motives of the studies by both Markland and Hardy (1993) and Markland and

Ingledew (1997), while social recognition is the lowest and second-lowest ranking motive, respectively.

Alternative inventories designed to measure individual motives for participating in physical activity include the Reasons for Exercise Inventory (Silberstein, Striegel-Moore, Timko, & Rodin, 1988), the Motivation for Physical Activity Measure (C. M. Frederick & Ryan, 1993), and the Personal Incentives for Exercise Questionnaire (Duda & Tappe, 1989). However, all of these inventories represent fewer scales than the EMI or EMI-2 and are hence not as suitable in this specific context.

4.2.3 Resources in the COR-E impacted by physical activity

The empirically confirmed objective benefits of physical activity, as well as subjectively established motives for participating in physical activity, have been outlined above. Based on this information, the 74 resources proposed by the COR evaluation scale (cf. chapter 2.1.3) were screened to identify which resources might reflect the multiple effects of physical activity on an individual. A total of 22 resources, or about 30% of the total of 74 resources, are hypothesized to be *directly* impacted by physical activity; additional resources may be impacted secondarily. Again, this supports the assumption that physical activity is a powerful intervention.

Based on the previously elaborated findings on the effects of activity on physical health and fitness as well as the and the individual motives of increasing nimbleness and strength and endurance, two related resources have been identified in the COR-E: (1) "stamina/endurance" and (2) "personal health".

Drawing on the individual motives regarding the *social aspects* of physical activities (i.e., seeking social recognition, affiliation, and competition) and on the fact, that many effects of physical activity on psychological health are assumed to be

facilitated by psychosocial mechanisms and social reinforcement (refer to Figure 4-3), the following six resources have been selected from the COR-E: (3) "companionship", (4) "involvement in organizations with others who have similar interests", (5) "feeling valuable to others", (6) "people I can learn from", (7) "ability to communicate well", and (8) "acknowledgement for accomplishment".

The largest number of resources were selected based on the findings that physical activity has a positive effect on mood and emotions as well as on self-esteem and self-perceptions—most prominently including feelings of mastery, control, and self-efficacy. This was complemented by the psychologically-founded individual motives for participation in physical activity, including for stress management, revitalization, enjoyment, and challenge. All together, 14 additional motives have been identified: (9) "positive feelings about myself", (10) "feeling that I know who I am", (11) "feeling that I am successful", (12) "feeling that I am accomplishing my goals, (13) "feeling my future success depends on me", (14) "feeling that I have control over my life", (15) "feeling independent", (16) "hope", (17) "sense of optimism", (18) "sense of commitment", (19) "sense of pride in myself", (20) "self-discipline", (21) "motivation to get things done", and (22) "positively challenging routine".

In the COR terminology, these 22 resources are all either conditions or personal characteristics. Naturally, object resources are not directly impacted by physical activity. On the other hand, energy resources may be negatively affected by an increase in activity. Obviously, participating in physical activity requires an investment of time, which may reduce the availability of free time, time for work, time with loved ones, or time for adequate sleep (the four time-related resources suggested by the COR-E). Additionally, some forms of physical activity, e.g., going to a gym or being member of a sports club, may require the investment of money. Furthermore, physical activity may in certain circumstances also result in the loss of additional resources, e.g., as a consequence of having less time available

or resulting from the aforementioned physiological and psychological hazards associated with physical activity. However, drawing on what has been discussed in the context of the potentially negative effects of physical activity, and under the conditions that physical activity is pursued out of free personal choice and in a moderate frequency and intensity, it is reasonable to assume that resource gains will generally far exceed resource losses.

4.3 Subjective well-being as a proxy for resources

In this chapter it will be argued that the development of a person's resources is directly reflected in his or her subjective well-being. First, chapter 4.3.1 reviews the current thinking in the field of subjective well-being. Chapter 4.3.2 then establishes the conceptual differences between resources and subjective well-being and concludes by proposing a model for reconciling the two concepts. It will be shown that it is indeed viable to use a measure of subjective well-being as a proxy for determining an individual's resources—as will be the case in the SOEP study (chapter 5).

4.3.1 Subjective well-being research: state of the art

Diener (2000) defines subjective well-being as "people's evaluations of their lives" (p. 34), where a "person who has pleasant emotional experiences is more likely to perceive his or her life as being desirable and positive" (Diener, 1994, p. 106). Diener (1994) notes that subjective well-being is often not defined explicitly but rather implied. Nevertheless, three fundamental characteristics of subjective well-being can be identified: (1) it concerns a subjective experience rather than measurable facts, (2) it encompasses both cognitive and affective evaluations, and (3) it is defined not by the mere absence of ill-being (negative definition), but by the additional presence of positive affect (positive definition). Current research also dis-

cusses the existence of a 'hedonic treadmill', i.e., the recurring adaptation to a hedonic set-point, and the extent to which subjective well-being is determined by personality traits versus environmental factors. The following paragraphs will elaborate on these points.

First, early studies found only small correlations between objective indicators of well-being—such as wealth, youth, and social privilege—and subjective measures of well-being. Costa and McCrae (1980) refer to the studies of Campbell (1976) and Andrews and Withey (1976), which can only predict 17% respectively 8% of variance in life satisfaction, based on several demographic indicators. As Campbell (1976) puts it, objective measures of well-being are surrogate indicators: "they describe the conditions of life that might be assumed to influence life experience, but they do not assess that experience directly" (p. 118). Diener and Lucas (1999) make an illustrative point for the resulting need for more subjective indicators of well-being:

> "The concept of the 'good life' varies considerably among individuals. For some, this ideal state is one of wealth and luxury; for others, it is attained through meaningful relationships with friends and family. For still others, the physical comforts of wealth and security are forgone to provide better lives for those in need. These different kinds of individuals would appear to be quite different in external circumstances, yet they might all share a subjective feeling of well-being." (p. 213)

Consequently emerged the field of *subjective* well-being, which focuses on peoples' *individual* judgments of their life satisfaction, their satisfaction with specific domains such as work or love, as well as their levels of positive and negative affect (Diener, 2000).

Second, subjective well-being encompasses affective and cognitive components, which are partially separable. The cognitive component has been described as *satisfaction* and defined as "the perceived discrepancy between aspiration and achievement, ranging from the perception of fulfillment to that of deprivation"

(Campbell, Converse, & Rodgers, 1976b, p. 8). It is often a global judgment, looking back on one's life as a whole (e.g., Seligman and Csikszentmihalyi (2000) relate 'satisfaction' to the past). The affective or hedonic component, on the other hand, is based much more in the immediate present and denotes an experience of ongoing pleasant affect and infrequent unpleasant affect. Some authors also refer to the affective component as happiness (e.g., Campbell et al., 1976b). Diener (1994) argues that while life satisfaction (the cognitive component) and hedonic balance (the affective component) are likely to diverge to some extent, they are still "likely to correlate because both are influenced by appraisals of one's life events, activities, and circumstances" (p. 107), and they "correlate at levels sufficient to say that they are parts of a higher order construct" (p. 108). Hence, the two components of subjective well-being do not per se have to be considered separately.

Third, based on the distinction between cognitive and affective components, a person is said to have high subjective well-being when she "reports that her life is satisfying, that she is experiencing frequent pleasant affect, and that she is infrequently experiencing unpleasant affect" (Diener & Lucas, 1999, p. 213). The notable aspect of this definition is that it is a *positive* definition of well-being. Although the definition requires an absence of unpleasant affect (a negative definition), it equally demands the presence of both pleasant affect and satisfaction with life (two positive definitions). The novelty of this view is that it suggests that well-being is more than the absence of ill-being. In contrast to what traditional conceptions of health suggest, the mere state of absence of ill-being is not sufficient to qualify as 'well-being'. Rather, well-being is a state in its own right and can be positively defined. This novel view is clearly rooted in positive psychology and includes the idea that well-being is not only to be sought as a *re*action to ill-being, but should be sought *pro*actively as an end in itself {e.g., \Keyes, 2009 #258}.

The effects of personality and situation

Despite the general agreement on these central aspects of subjective well-being, there is an ongoing debate about the extent to which specific personality traits determine levels of well-being. Costa and McCrae (1980) make a very illustrative point:

> "Few would argue against the position that, for normal people, the major determinant of momentary happiness is the specific situation in which the individual finds himself or herself. Social slights hurt our feelings, toothaches make us miserable, compliments raise our spirits, eating a good meal leaves us satisfied. The contribution of personality to any one of these feelings is doubtless small. Yet over time, the small but persistent effects of traits emerge as a systematic source of variation in happiness, whereas situational determinants that vary more or less randomly tend to cancel each other out." (p. 676)

Overall, it is undisputed that personality does influence subjective well-being - an influence that Diener and Lucas (1999) deem 'moderate'. The most robust findings relate to the extraversion and neuroticism traits, where extraversion is positively correlated with positive affect and neuroticism is positively correlated with negative affect (see Figure 4-5). Extraversion and neuroticism are evidently strong predictors of well-being even over long periods of time (Costa & McCrae, 1980; Diener & Lucas, 1999). Other Big Five traits exhibit only week relations to subjective well-being, and although traits like self-esteem and optimism do correlate with subjective well-being, there is not yet sufficient evidence for the directions of these correlations (Diener & Lucas, 1999). Regarding the question of *why* some aspects of personality are related to subjective well-being, Diener and Lucas (1999) present a comprehensive review of explanatory theories.
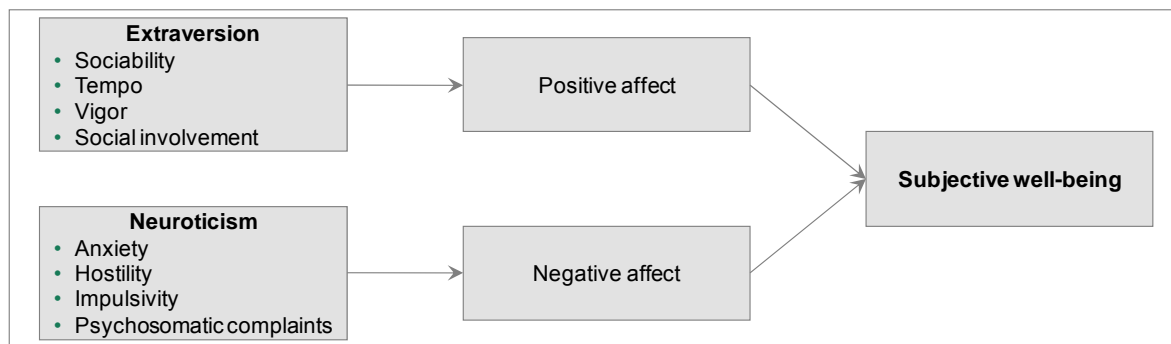
Figure 4-5   **Costa and McCrae's (1980) model of personality influences on subjec-
tive well-being**

There is less agreement, however, on the *extent* to which personality influences subjective well-being. Costa and McCrae (1980; 1984) assume that personality influences subjective well-being well over and above the effects of temporary moods or states, and Meyer and Shack (1989) postulate the convergence of mood and personality. According to Diener and Lucas (1999), however, the highest empiric estimate of the effect of genetic variations on subjective well-being is reported by Lykken and Tellegen (1996), who attribute around 50% of variance in subjective well-being to heritability and hence to the genetic lottery. The conclusion of this most 'aggressive' estimate is that "the variance in adult happiness is determined about equally by genetic factors and by the effects of experiences unique to each individual" (Lykken & Tellegen, 1996, p. 189). In other words, situational and environmental factors still account for *at least* 50% of subjective well-being.

While the number of personality traits is limited, there is a wide range of situational and environmental factors that influence subjective well-being. These factors can be grouped into different classes, e.g., according to their temporal persistence. The first category of situational factors relates to momentary stimuli; these imply that self-reported well-being is to some extent influenced by rather random and temporally unstable factors. There is empirical evidence that people's well-being reports are impacted by arbitrary conditions such as the weather (Schwarz

& Clore, 1983), current mood, and information least made accessible (Schwarz & Strack, 1991). However, when aggregated over time, these momentary variations in an individual's response can be eliminated, revealing a stable level of subjective well-being (Diener & Larsen, 1984; Diener & Lucas, 1999). The second category on the continuum of temporal persistence relates to life events. Suh et al. (1996) have demonstrated that life events—positive ones such as getting promoted, becoming an uncle/aunt or improving financial status, as well as negative ones such as death of a close friend, having an operation or getting laid-off—do influence subjective well-being. One caveat to mention here is that life events have been found to have only a temporally limited effect on subjective well-being: while recent events (i.e., within the last six months) did correlate with subjective well-being, distal life events (i.e., between seven months to four years prior) did not correlate (Suh et al., 1996).

The third category of non-personality influence factors contains yet more durable conditions than life events and can generally be labeled as demographic factors and life circumstances. A comprehensive overview and review of these is provided by Argyle (1999), who lists marriage, employment, and leisure as the three major sources of subjective well-being, but also considers factors such as age, education, social class, social relationships, social support, physical activity, and religion. Probably the most highly remarked-upon research finding in this context is the relatively weak effect of income on subjective well-being, which is the case especially for inhabitants of wealthy countries which are above a level at which income does affect happiness (Diener, Sandvik, Seidlitz, & Diener, 1993; Haring, Stock, & Okun, 1984). The final category is at the furthest pole of the temporal persistence continuum and refers to the impact of culture on subjective well-being. Cultural variables shown to be relevant include, for example, individualistic versus collectivistic values of a culture, and cultural norms regarding expression of

pleasant or unpleasant emotions (Diener, Oishi, & Lucas, 2003; Diener & Suh, 1999; Schimmack, Oishi, Radhakrishnan, Dzokoto, & Ahadi, 2002).

However, the field of subjective well-being lacks a comprehensive and integrated model of subjective well-being that clarifies the causal impact of person and situation factors. An approximation has been proposed by Stones and Kozma (1991). Their nonlinear mathematical 'magical model of happiness' accounts for (a) personality factors, (b) situational factors which are distinguished into a prevailing environmental component and an episodic environmental component, and notably (c) the *interaction* between the two. While the interaction between person and situation factors has not yet been discussed above, current thinking and research emphasize its relevance. E.g., Diener et al. (2003) acknowledge that "it is also likely that there are indirect or interactional effects, such that different events and life circumstances affect well-being differently depending on one's personality" (p. 409) and Argyle (1999) states that "we know from other research that not only do persons and situations add up, but they also interact, so that there is a lot of P × S variance" (p. 368).

Empirical research from different domains of psychology provides support for the existence of interactional effects. Emmons (1991) finds a relevant interaction between life-events and relatively stable personal strivings: "what is critical for a person's well-being are not random positive and negative life events, but rather events that impinge upon a person's goals and commitments" (p. 454). Supporting the idea that the congruence of personality and situational factors is a prerequisite for well-being, Kette (1991) finds that prisoners high on extraversion were less happy than prisoners high on introversion. Similarly, Oishi, Schimmack, and Diener (2001) show that the experience of physical pleasure is a stronger predictor of daily satisfaction for high sensation-seekers than for low sensation-seekers. Not directly related to subjective well-being, but still offering transferrable conclu-

sions, there is evidence that levels of *state* anxiety are both dependent on person (*trait* anxiety) and situation factors, such that trait and situation need to be congruent in order to evoke high state anxiety (Endler, Crooks, & Parker, 1992; Endler & Kocovski, 2001). Notably, the person-situation interaction is fostered by self-selection into situations: people tend to choose situations that are congruent with their personal dispositions (Atkinson, 1957; Emmons, Diener, & Larsen, 1986).
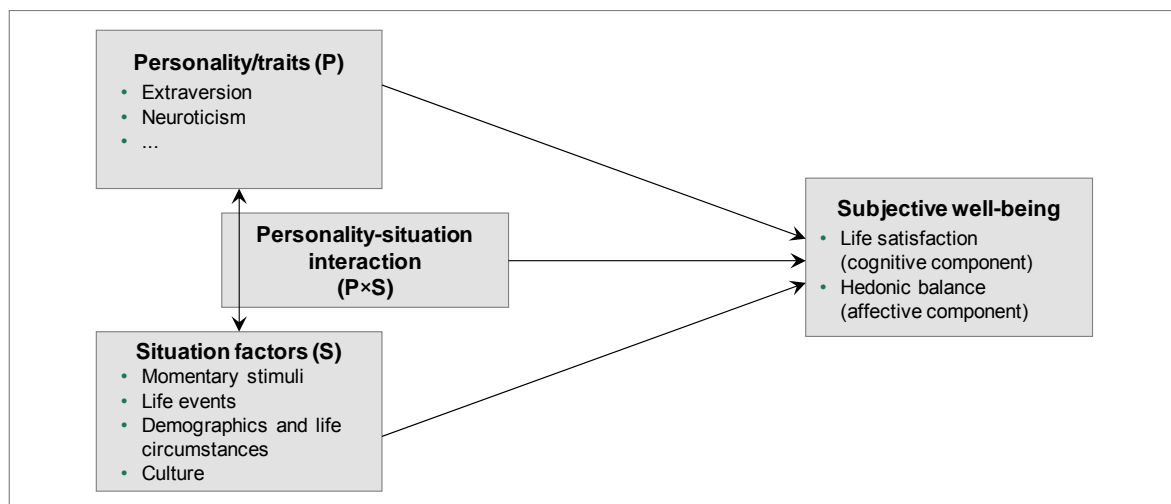
Figure 4-6   A high-level model of subjective well-being

Hence, an interactional model of subjective well-being is proposed in Figure 4-6, recognizing the roles of personality and situation factors, as well as their interaction. The relative weight of the different causal relationships, however, remains to be clarified by ongoing research in the field.

The hedonic treadmill

Hedonic adaptation is another issue being discussed controversially in the field of subjective well-being. Research suggests that even disruptive life-events such as winning the lottery (Brickman, Coates, & Janoff-Bulman, 1978) or imprisonment (Bukstel & Kilmann, 1980) do not have a sustained effect on subjective well-being,

but that the effects rather lessens over time. Suh et al. (1996) found that for most live events, the impact on subjective well-being deteriorates after three months. Findings like these have inspired the conception that people continually acclimate to their current situation and that happiness is not a function of absolute, but rather of relative life circumstances. This idea has been termed the 'hedonic treadmill' and has become prominent as adaptation-level theory (Brickman & Campbell, 1971). Coming to the same result but following a different line of argument, set-point theory—originally introduced as the dynamic equilibrium model (Headey & Wearing, 1989)—suggests that people have individual equilibrium levels of well-being (i.e., set-points). Although they depart from these levels as the consequence of positive or negative life events, they return to them over time (Headey & Wearing, 1992).

Both the hedonic treadmill and set-point theory support the conclusion that subjective well-being is stable across situations and across the life-span, thereby advocating the strong influence of biological factors on well-being and the limited possibilities to manipulate an individual's well-being by internal or external circumstances. While this implies that adverse external events do not have the power to destroy individuals' happiness on a medium- to long-term basis (certainly an attractive proposition), it is at the same time a view that fundamentally contradicts the principles of humanism. From a humanistic point of view it may therefore be comforting that recent research is increasingly establishing the limitations of adaptation and set-points and questioning the validity of these theories. Frederick and Loewenstein (1999) find several domains—such as noise nuisance, food, and erotic stimuli—which do not obey the mechanisms of habituation, and hence discuss several promoters and inhibitors of hedonic adaptation. Meanwhile Fujita and Diener (2005) and Headey (2007) propose a revision of set-point theory, based on new findings derived from the SOEP data set:

"Our analyses indicate that over long periods of time there is modest stability in LS [life-satisfaction] and that some individuals do change significantly and substantially in LS. Thus, there appears to be a 'soft baseline' for LS, with people fluctuating around a stable set point that nonetheless does move for about a quarter of the population. […] Thus, almost 10% of the sample showed a change in mean-level satisfaction equal to or greater than 3 points on the 10-point scale, a large change for 5-year averages." (Fujita & Diener, 2005, p. 162)

Another field of research touches on the question of how the resources discussed in psychological resource theories relate to subjective well-being. The following chapter will discuss the current understanding in this regard and propose a new model for reconciling resources and subjective well-being.

4.3.2   Contrasting and reconciling subjective well-being and resources

Early studies found only very small correlations between resources and subjective well-being (Campbell, Converse, & Rodgers, 1976a; Diener et al., 1993; Diener, Wolsic, & Fujita, 1995; Okun & George, 1984). Hobfoll (1988; 1989b), however, suggests that resource surpluses create eustress, and well-being researchers find it plausible that resources should predict subjective well-being: "the belief that resources should correlate substantially with SWB [subjective well-being] is based in part on the idea that people with many assets are better able to fulfill their needs" and "therefore experience higher positive affect" (Diener & Fujita, 1995, p. 926). Additionally, subjective well-being studies performed in a number of different countries showed that certain resources, e.g., fulfillment of basic physical needs, correlated strongly with that country's mean subjective well-being (Diener, Diener, & Diener, 1995).

It is important to understand the differences between the two concepts of resources and subjective well-being, as this helps to explain why the cited studies found only very small correlations. For purposes of clarity, this analysis will be

based on resources as defined by COR theory. First, COR theory takes a more ob-jective perspective on resources than does *subjective* well-being; COR theory stresses the limits of appraisal and the relative equality in valuing resources at least within the same culture. As discussed in the preceding chapter, *subjective* well-being emphasizes that different individuals may evaluate the same resource very differently. However, the COR evaluation scale (COR-E; cf. chapter 2.1.3) is in fact designed as a subjective self-rating measure and hence allows some room for subjective appraisal. Second, researchers in the field of subjective well-being have carried out extensive empirical research to distinguish the different resources according to the strength of their impact. As discussed in the preceding chapter, the strongest influence is associated with personality traits such as extraversion and neuroticism, followed by the cumulative influence of situational factors based in culture, demographics and life circumstances, life events, and momentary stim-uli (in order of decreasing strength). COR theory, on the other hand, does not stress the influence of personal factors or the resources belonging to the 'personal characteristics' group; nor does it suggest a qualitative differentiation between the remaining resources at all. Quantitatively, non-personality resources even out-number personality-related resources—both in the COR-E and in view of the fact that three of the four resource categories (energies, conditions, and objects) are situational (see chapter 2.1). Third, the COR model, which represents resource main effect, entirely ignores the possibility that different subsets of resources might interact and also generate interaction effects. As discussed in the preceding chapter, recent models of subjective well-being do account for interactional effects between person and situation factors. In their magical model of happiness, Stones and Kozma (1991) even suggest that subjective well-being is best modeled based on non-linear mathematics. Fourth and finally, COR theory focuses on the change rather than the stability of resources. A significant part of COR research is con-cerned with change-related aspects such as resource loss and resource gains, loss

and gain spirals, and the investment of resources. Similarly, the COR-E measure evaluates relative changes in resource levels, rather than absolute resource levels. Hence the COR approach is based on the assumption that resources change over time, while the subjective well-being approach assumes stable set-points and long-term stability (as discussed in chapter 4.3.1). Relatedly, well-being research assumes that surplus resources are spent (i.e. they disappear) rather than systematically increased to hedge future losses (cf. Morris, 1999, p. 180 f.). To summarize, resources (as defined by COR theory) and subjective well-being can be contrasted on four dimensions: (1) objective/nomothetic versus subjective/idiographic approach, (2) equality of resources versus hierarchy of resources, (3) ignoring versus including interaction effects, and (4) assuming long-term change versus stability of resources. Figure 4-7 depicts these four dimensions, as well as the four levers for reconciling resources and subjective well-being, which are suggested and discussed in the following paragraph.
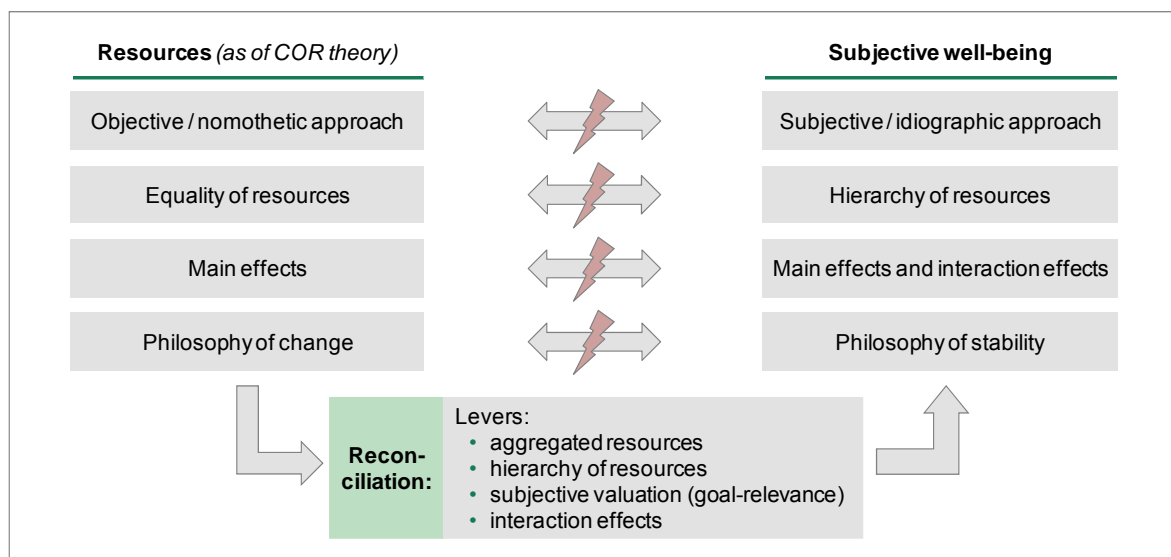
Figure 4-7   **Contrasting and reconciling resources and subjective well-being**

Based on the above consideration of the differences between resources and subjective well-being, an attempt shall be made to reconcile the two concepts. In the fol-

lowing, four major levers designed to increase the correlations between resources and subjective well-being are presented. These are partially grounded in empirical evidence by Diener and Fujita (1995), who studied the relationships of subjective well-being (including cognitive and affective component), individual resources (drawing on 21 informant-rated resources), and major personal goals or strivings. The first lever refers to the need to aggregate resources: while single resources are only modest predictors of subjective well-being, a person's aggregated resources are a stronger predictor of subjective well-being. Diener and Fujita (1995) find that on average, aggregated resources account for nearly 20% more variance than the single resources. This notion is already in line with the thinking of COR theory. As an *integrated* resource theory (see chapter 2.4), COR theory takes a comprehensive approach to resources; hence when developing the COR-E for the measurement of individuals' resources, Hobfoll et al. (1992) sought to create an exhaustive list, which ultimately comprised 74 resources.

The second lever draws on the fact that different *classes* of resources can be distinguished according to the strength of their correlation with well-being. As discussed in the preceding chapter, personality traits may have a stronger impact on subjective well-being than single situational factors, and there is also variation in the impact strength among the different types of situational factors (e.g., momentary stimuli versus demographic factors). In Diener and Fujita's (1995) study, social resources (e.g., family support, social skills) and internal resources (e.g., energetic, self-confident) were more predictive of subjective well-being than were external resources (e.g., money, material possessions). Similar findings have often been replicated. For example, Argyle (1999) reviews the independent effects of different variables on subjective well-being; one of his findings is that marriage is a strong correlate and income is not. Hence a hierarchy of resource classes needs to be accounted for when subjective well-being is predicted based on resources;

this can be done, e.g., by assigning to the different resource classes different multipliers, which reflect the resource classes' relative strength of effect. Notably, such a multiplier would need to reflect two additional impact factors: (1) the overvaluation of losses and (2) the particular form of the relationship. The former factor accounts for the well-replicated finding that losses or negative events are valued higher than gains or positive events (Gomez, Krings, Bangerter, & Grob, 2009; Kahneman & Tversky, 1979; Suh et al., 1996; S. E. Taylor, 1991); see also chapter 2.3. COR theory provides for this factor by (a) postulating the primacy of loss as discussed in chapter 2.3 and (b) designing the COR evaluation tool so that losses and gains are indicated separately for each resource, instead of being averaged (cf. chapter 2.1.3). Based on this data, losses can be transformed via a multiplier or a more complex operation to emulate their overvaluation. The latter impact factor, the particular form of the relationship, refers to what has been discussed in chapter 2.5: the possibility that the resource-eustress curve may show an asymptotic or reversed (i.e., U-shaped) course instead of a stable gradient. Edwards (1992) provides an excellent account of the underlying logic:

> "The expected form of the relationship between a discrepancy and well-being depends on the nature of the desire involved. For desires that represent optima, discrepancies that are either positive (i.e., perceiving more than desired) or negative (i.e., perceiving less than desired) will damage well-being. Desires that represent ranges of acceptability will yield similar effects, provided that perceptions deviate beyond the acceptable range. For desires that represent minima, negative discrepancies will damage well-being and positive discrepancies will slightly improve well-being, whereas for desires that represent maxima, positive discrepancies will damage well-being and negative discrepancies will slightly improve well-being" (p. 252).

Hence the effect of material resources such as income should be treated as a minimum desire, while other resources, such as time for work or time for leisure, rather represent ranges of acceptability. In contrast to the following lever, this second lever can be considered a nomothetic factor, since its three components—the

hierarchy of resources according to their impact on subjective well-being, the overvaluation of losses, and the resource-specific form of the relationship with subjective well-being—tend to be stable across individuals.

In contrast, the third lever is idiographic and reflects the finding that resources are more strongly correlated with subjective well-being when their relevance to an individual's goals are taken into account. People whose highest resources are in areas that are more relevant to their personal goals tend to have higher subjective well-being than people whose highest resources are in areas less relevant to their personal strivings (Diener & Fujita, 1995; Emmons, 1991). The data collected by Diener and Fujita (1995) even suggests that congruence overrules quantity, i.e., the congruence between goals and resources is more important than the absolute amount of resources. Consequently, predictions of individual subjective well-being should factor in the idiographic goal-relevance of each resource. Specifically, each resource should be weighted according to its goal-relevance, where the goal-relevance ranges between not relevant (e.g., a weight-multiple of 0) and fully relevant (e.g., a weight-multiple of 1).

The fourth lever proposes that interactional effects among resources be accounted for. As extensively discussed in the preceding chapter, there is an increasing amount of evidence for interactional mechanisms among person factors and situation factors in particular. Although COR theory does not consider interactional effects, a reliable resource-based prediction of subjective well-being needs to allow and account for the effects caused by interactions among subsets of resources. Clearly, more research is required to understand the nature of the interactions between the different resources. Until more information is acquired in this respect, however, it should be assumed that any one resource could potentially interact with any other resource. In view of the diverging nature of losses and gains, it should even be assumed that (a) any resource gain may interact with any other

resource gain, (b) any resource gain may interact with any resource loss, and (c) that any resource loss may interact with any other resource loss.

In addition to these four levers, a person's subjective well-being in any given moment must be expressed in reference to his or her subjective well-being at an earlier time. This is to account for habituation (discussed in chapter 4.3.1), which suggests that the relative *change* in resource levels, not the absolute level of resources, is relevant for subjective well-being. As an example, job satisfaction has been found to be unrelated to the absolute level of pay, but strongly positively correlated with a recent change in pay (Clark, 1999). This finding can easily be reconciled with COR theory, as COR theory also stresses the importance of relative changes compared to absolute levels. Consequently, the COR-E is designed to measure recent changes in resources rather than absolute levels of resources; e.g., in the instructions it emphasizes that participants should not rate the availability of a resource, but the change in the availability of a resource (Hobfoll, 2007).

Thus, four levers and one postulate have been suggested to enhance the prediction of subjective well-being based on resources. Putting these into an actual mathematical formula, an individual's subjective well-being at the point in time t (SWB_t) can be predicted based on three terms which are to be additively linked: the first term represents the person's subjective well-being at an earlier point in time *t-1*; the second term comprises the valuated resource changes that occurred between *t-1* and *t*; and the third term indicates the interactions between resources (see Figure 4-8).

$$SWB_t = \boxed{SWB_{t-1}} + \boxed{\text{Valuated resource change}} + \boxed{\text{Interaction}}$$

$$= \boxed{SWB_{t-1}} + \boxed{\substack{\text{Valuated} \\ \text{resource gains}}} - \boxed{\substack{\text{Valuated} \\ \text{resource losses}}} + \boxed{\text{Interaction}}$$

$$= \boxed{SWB_{t-1}} + \sum_{i=1}^{n}(r_{g_i} \cdot n_{g_i} \cdot g_i) - \sum_{i=1}^{n}(r_{l_i} \cdot n_{l_i} \cdot g_i) + \sum_{i,j=1}^{n}(r_{g_i} \times r_{g_j}) + \sum_{i,j=1}^{n}(r_{g_i} \times r_{l_j}) + \sum_{i,j=1}^{n}(r_{l_i} \times r_{l_j})$$

r_{g_i} := amount of resource i that has been *gained* between t-1 and t

r_{l_i} := amount of resource i that has been *lost* between t-1 and t

n_{g_i} := nomothetic valuation of *gains* of resource i

n_{l_i} := nomothetic valuation of *losses* of resource i

g_i := idiographic valuation (=goal relevance) of resource i

Figure 4-8   **A mathematical model for reconciling resources and subjective well-being**

The combination of the first and second terms accounts for the postulate that subjective well-being needs to be a function of the relative change in resource levels instead of a function of absolute resource levels. Notably, the second term is designed to additionally reflect the first three of the four levers that have been discussed in this chapter. Referring to the first lever, the formula considers a greater number of n resources—indicated by the index i = {1, 2, …, n-1, n} of the resource variable—which are then aggregated. Since the second term describes the *valuated* resource changes, it also reflects the second lever, which stipulates a three-fold nomothetic valuation, and the third lever, which claims an additional idiographic valuation. Specifically, the nomothetic valuation is represented by the variables n_{gi} and n_{li} which are intended to cover the three components of a nomothetic valuation that have been discussed above: (1) since the variable n carries the resource-index i, resources can be grouped into a hierarchy and weighted according to the effect of their resource class; (2) for the same reason, n can account for the potentially different relationships between single resources and subjective well-being

(e.g., distinguishing a linear relationship from a U-shaped relationship); (3) since the multiple n for the gains of a resource i (which is n_{gi}) is potentially different from the multiple n for the losses of the same resource i (represented by n_{li}), it becomes possible to overvalue losses over gains. The idiographic valuation, on the other hand, is provided for by the variable g_i which is designed to reflect the goal variance of resource i. Mathematically speaking, g_i should range between 0 for a resource i that is totally irrelevant for an individual's goals and 1 for a resource i that is fully and exclusively relevant for an individual's goals. Finally, the third term accounts for the fourth lever, which stipulates the consideration of possible interactional effects between resources. Due to lack of research on the exact nature of these interactional effects, the term attempts to be exhaustive and hence considers (a) interactions between the resource gains of two resources, (b) interactions between the resource gain of one resource and the resource loss of another, or the same, resource, and (c) interactions between the resource losses of two resources.

As an amendment to the mathematical model in Figure 4-8, Figure 4-9 offers a synonymous graphical model. Essentially, the graphical model depicts the relationship between resources and subjective well-being in the same way that these relationships are expressed in the mathematical model. While it may be easier and more intuitive to read than the mathematical model, the graphical model has a drawback in that does not distinguish between additive and multiplicative links.

In summary, individuals' resources can clearly be related to their subjective well-being. Four major dimensions were identified in which the concepts of resources and subjective well-being can be differentiated from each other (as outlined in Figure 4-7), and four corresponding levers for reconciling the two concepts were presented. In addition, a mathematical model (and its graphic representation) was developed to further specify the reconciliation between resources and subjective well-being according to these levers. This model stresses the point that resources

can be considered the most prominent causal factor for subjective well-being. To give a formula-based example: assuming that between *t-1* and *t* no resources are gained and no resources are lost, this leads to terms two and three equaling zero, which in turn results in subjective well-being remaining unaltered, since SWB_t equals SWB_{t-1}. If, on the other hand, no resource gains are recorded—with the consequence that the first half of term two equals zero—and assuming further that some resource losses are recorded, subjective well-being will as a result always[2] decrease. Consequently, the development of a person's resources is directly reflected in his or her subjective well-being.
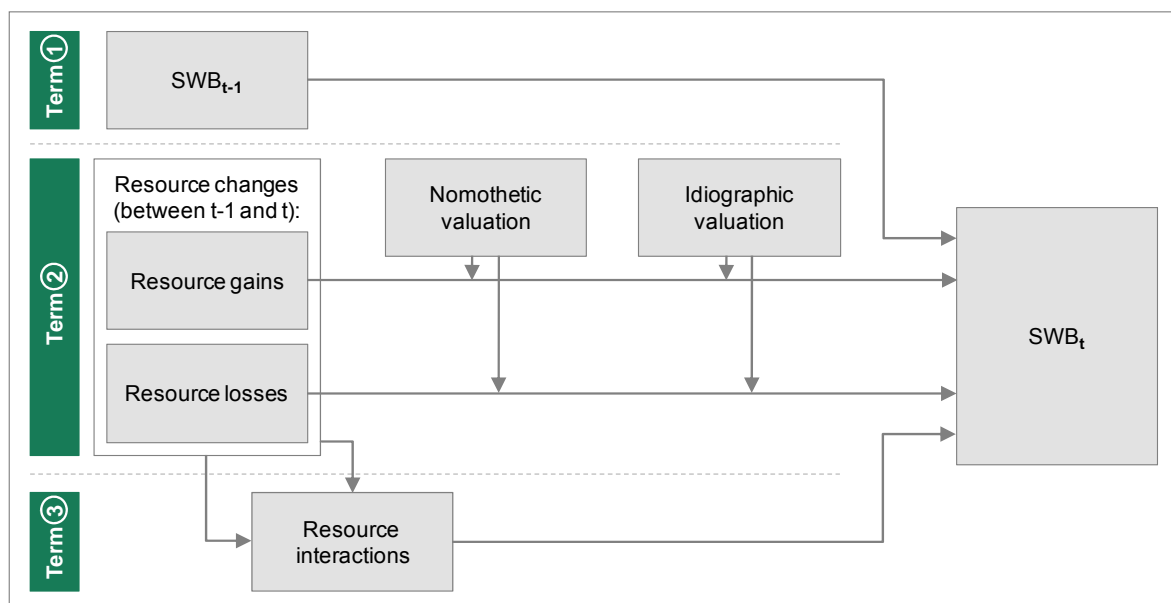
Figure 4-9   A graphical model for reconciling resources and subjective well-being

One concluding side note remains. According to Diener and Fujita (1995), resources more strongly predict the cognitive component of subjective well-being (life satisfaction) than the affective component (hedonic balance of positive and negative affect). Therefore, predicting solely the cognitive component of subjective

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[2] The only exception being that all of the lost resources have a nomothetic value of 0, i.e., are totally irrelevant for the person's goals.

well-being, rather than the global measure may further enhance the relationship between resources and subjective well-being. In terms of the mathematical model in Figure 4-8 (and the graphical representation in Figure 4-9), this would imply substituting 'subjective well-being at time t (SWB$_t$)' for 'life satisfaction at time t'.

4.4 Predictions and research design

Based on the considerations presented in this chapter, the following hypotheses can be formulated. Notably, the first two hypotheses relate to the first tier of the research agenda proposed in chapter 3.3, and the third hypothesis to the second tier.

Hypothesis 1: Subjects who recently started participating in physical activity exhibit higher levels of resource gains *(hypothesis 1a)*—respectively higher levels of subjective well-being *(hypothesis 1b)*—than subjects who remain physically in-active (between-group design).

Hypothesis 2: Subjects who recently started participating in physical activity exhibit higher levels of resource gains *(hypothesis 2a)*—respectively higher levels of subjective well-being *(hypothesis 2b)*—than they did before participating in physical activity (within-subject design).

Hypothesis 3: Following the initial resource gain, resources *(hypothesis 3a)*—and therefore also subjective well-being *(hypothesis 3b)*—continue to increase at an exponential rate over time.

These hypotheses were separately tested in two longitudinal studies (cf. Figure 4-10). The first study is based on data that was made available by the German So-cio-Economic Panel Study (SOEP) at the German Institute for Economic Research in Berlin (DIW Berlin); for a description of the SOEP see Wagner, Frick and

Schupp (2007) and Wagner, Göbel, Krause, Pischner and Sieber (2008). In the data obtained from the SOEP, the measure of subjective well-being (SWB) is taken as a proxy for resources. Thus, in the *SOEP study* (see chapter 5), gain spirals following the initiation of regular physical activity are tested between subjective well-being over time. The second study was conducted as part of this thesis among new members of several fitness centers. In this data, resources are measured in terms of the COR-E. Thus, in the *gym study* (see chapter 6), gain spirals following the initiation of regular physical activity are tested between resources in the narrow sense over time.

		SOEP study	Gym study
Hypothesis 1: Positiv effect of physical activity on resources *(between-groups)*	1a: Resources		✓
	1b: SWB as proxy[1]	✓	
Hypothesis 2: Positiv effect of physical activity on resources *(within-subjects)*	2a: Resources		✓
	2b: SWB as proxy[1]	✓	
Hypothesis 3: Resources continue to increase at an exponential rate over time	3a: Resources		✓
	3b: SWB as proxy[1]	✓	

[1] Subjective well-being is considered as a proxy for subjects' resources; refer to chapters 4.1 and 4.3

Figure 4-10   Research design

5 Data set 1: SOEP study

The first longitudinal study, in which the hypotheses formulated in the preceding chapter were tested, is the German Socio-Economic Panel (SOEP) study. The SOEP is a longitudinal study which began in 1984 and has now been in place for over a quarter of a century (Wagner et al., 2008). In essence, it reports annual microdata for the measurement of biographical developments, with a focus on economic data (e.g., income and employment) and sociological data (e.g., subjective well-being and time use). The SOEP is a household panel and, more importantly, a cohort study. As such, it administers repeated measurements to identical subjects with the objective of following subjects as long as possible over time and space (Wagner et al., 2007). A major advantage of the longitudinal design is that it allows for causal interpretations.

5.1 Description of the panel

The SOEP began in 1984 as a representative cross-section of the adult population living in private households in Germany. As a general rule, data is gathered on all persons living in a selected household, including the unborn. All adult household members (i.e., 17 years and older) are interviewed individually.

Over time, the sample has been enhanced and enlarged to (a) ensure continuous representativeness and (b) compensate for attrition (see Figure 5-1). First, the sample had to be adjusted after the reunification of Germany, and an East German sample was added to the main sample. Second, two samples which oversampled immigrants and one sample which oversampled high-income households were added. A specifically designed weighting mechanism ensures that the data is adjusted in order to account for the oversampling. Finally, three cross-section enlargements have been implemented to ensure the continuity of the panel size de-

spite attrition caused by death, moves abroad or dropouts (Wagner et al., 2007; Wagner et al., 2008).
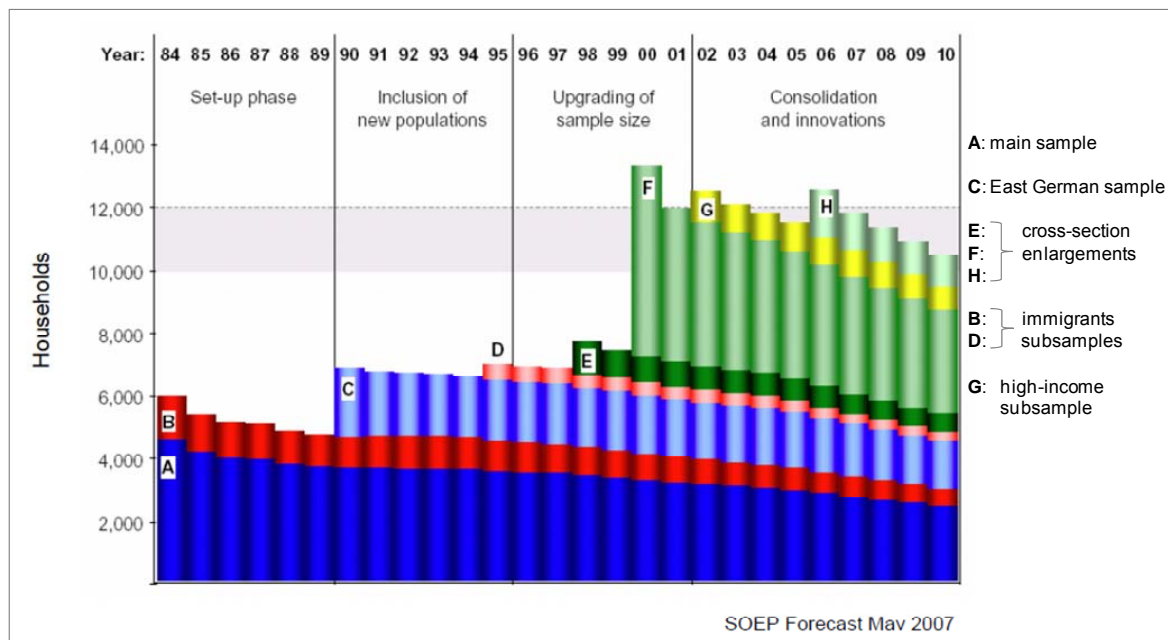
Figure 5-1   SOEP panel development (Wagner et al., 2007, p. 14)

The most recently available wave (year 2010) comprises data from 22,870 individuals living in 10,745 German households (Goebel & Haas, 2010a, 2010b). As to the longitudinal and cohort aspect of the SOEP, recent analyses report that in 2008 a total of *2,500 individuals* has been part of the study since its beginning in 1984 and thus have been interviewed in each of the 25 waves. As of 2009, an *additional 1,500 individuals* have been part of the panel since the inclusion of the East German sample in 1990 and thus have provided data in each of 20 waves (Wagner et al., 2008).

Themes investigated in the SOEP

Being a *socio-economic* panel, the SOEP combines microeconomic data with indicators based in the social, psychological, and political sciences (Wagner et al., 2008). The scope of the annual questionnaire includes a set of *core questions* that are administered every year and remain relatively stable over time, and one or more *fo-*

cus topics that vary from year to year (refer to Figure 5-2). The core questions include information on demography, education, occupation, income, housing, health, and satisfaction with life. Particularly this last measure will be relevant in the context of the research conducted in this thesis. The focus topics are drawn from a pool of topic modules, which include information on biography, social origin, assets, expectations for the future, working conditions, and time use. Again, this last measure will be particularly relevant in this thesis, since time use includes information on individuals' levels of physical activity.

Core questions (yearly)	Topic modules (varying)
• Population and demography • Education, training, and qualification • Labor market and occupational dynamics • Earnings, income, and social security • Housing • Health • Basic orientation (preferences, values, etc.) • Satisfaction with life in general and various aspects	• Biography including employment and marriage and family • Social origin • Neighborhood • Social security and poverty • Assets • Further education and training • Time use and preferences • Family and social networks • Working conditions • Expectations • Ecology and environmental behavior

Figure 5-2   Themes covered in the SOEP questionnaires (Wagner et al., 2008)

Collecting the data

In the annual site inspections of all SOEP households, all adult household members (i.e., 17 years and older) are directly questioned and thus provide the person-level data. One main informant per households is additionally questioned to provide the household-level data. In collecting this data, the SOEP deploys standardized, pre-tested measurement instruments. In the first wave of each sample, it is obligatory that the questioning takes place as a face-to-face interview. These face-to-face interviews are either paper-and-pencil interviews or, after 1998, computer assisted personal interviews. In all subsequent waves, participants can opt for the possibility to self-complete the questionnaires, with or without interviewer assis-

tance. In 2002, 57% of the interviews occurred face-to-face (29% pen-and-paper interviews and 28% computer assisted personal interviews), while 28% of the interviews were self-completed with or without interviewer (Frick, 2010).

Notably, a number of mechanisms are in place to assure the quality of the collected data (Wagner et al., 2008). First, the mode of questioning is coded for every interview and thus allows analyses regarding potential effects of the measurement instruments. Second, the interviewer is coded for every interview, which allows the identification of potential interviewer effects. Last, the longitudinal aspect of the SOEP allows for the detection of data that was forged by the interviewer; however, this is an issue for only less than 0.5% of interviews.

5.2 Method

5.2.1 Measures

All data was obtained from the most recent data set (SOEP v27), which was published in September 2011 and includes all waves from 1984 to 2010. For the analyses, the relevant data sheets were matched to create a flat file as described in Appendix A.a.

Independent variable: Participation in physical activity

The physical activity of panel members is measured within the topic module "time use". In this context, the SOEP questionnaire asks for participants' average time use and spare time activities. Active sports is one of the suggested spare time activities. The respective item in the questionnaire is phrased: "Which of the following activities do you take part in during your free time? Please check off how often

you do each activity: at least once a week, at least once a month, less often, never. → Doing sports yourself" (refer to Figure 5-3).

Since "time use" is a topic module in the SOEP, questions regarding sports behavior are not regularly included, but appear only in selected waves. The longest period of consecutive waves that asked for sports behavior was in years 1994 to 1999 (waves K to P; see Figure 5-4). This thesis concentrates on the data taken from these years in order to allow for the longest possible growth analysis. The year 1992 questionnaire (wave I) did also ask about sports participation and was additionally included as selection criteria for the investigated participants, but not included in the analysis. This procedural measure was taken in order to reduce learning effects (cf. Frick, Goebel, Schechtman, Wagner, & Yitzhaki, 2006) by making sure that each respondent of the sports question in year 1994 (wave K) had responded to the sports question at least once before.

Figure 5-3   Section of the SOEP questionnaire asking for sports behavior (English version, obtained from DIW, 2011)

Figure 5-4   Years (waves) in which panel was asked for level of physical activity

As will be described in chapter 5.2.3, participants were assigned to the experimental group and several control groups based on their indicated level of physical activity. Since this assignment took place in a retrospective and non-randomized fashion, this process represents a quasi-experimental design.

Dependent variable: Subjective well-being (i.e., life satisfaction)

Since its first wave in 1984, the SOEP has included cognitive measures of well-being: (a) satisfaction with life in general and (b) satisfaction with several life domains. Since studies have shown high correlations between the global life satisfaction measure and the average of the domain satisfaction measures (Schimmack, 2008), the analyses in this thesis are limited to satisfaction with life in general. The participants of the SOEP are asked about their satisfaction with life in general within the core questions that are administered annually. The answer is provided on an eleven-point Likert scale ranging from *completely dissatisfied (0)* to *completely satisfied (10)*; see Figure 5-5.

Figure 5-5   Section of the SOEP questionnaire asking for life satisfaction (English version, obtained from DIW, 2011)

Before the life satisfaction scores could be used in the data analysis, the scores were centered around the mean life satisfaction score for each year. A similar procedure has, e.g., been suggested and performed by Lucas et al. (2003), who investigate the impact of marital status on life satisfaction. When life satisfaction is compared across years, year mean centering is required in order to account for systematic biases that may be caused by annual national events such as an eco-

nomic crisis, low unemployment, a warm summer, or winning the soccer world cup.

Control variables

Age and *gender* were selected as control variables. Both were utilized as covariates for propensity score matching, which was required to balance sample sizes between the experimental group and control groups. Controlling for age is particularly important in the context of physical activity, since increased age may have a negative effect on the level of physical activity: older individuals may be less mobile, e.g., due to infirmity. Thus it is necessary to ensure that all age groups are equally represented across different experimental/control groups. Other variables were not expected to cause a systematic error and are therefore not considered. Furthermore, since the SOEP is designed to be representative of the German population, variables like economic status did not have to be controlled.

5.2.2 Participants and procedure

Equal to the measures data, all person-related data was obtained from the most recent data set (SOEP v27), including all waves from 1984 to 2010. From this wealth of data, all persons were selected who entered the panel in 1992 or earlier and did not leave the panel before 1999. Although the relevant time frame for the analyses was only from 1994 to 1999, the longer time frame was chosen in order to reduce biases from learning effects: it was thus ensured that all selected persons had answered the sports question at least once and the life satisfaction question at least twice prior to the studied time frame. Additionally, to ensure that the subjects were directly questioned ('adults' in terms of the SOEP), they had to be 17 years or older as of 1992 in order to be selected. Based on these requirements, 9,250 individuals were selected for the analysis.

5.2.3   Strategy of analysis

In order to test hypothesis 1B in the SOEP sample, subjects were post-hoc divided into three groups according to their sports behavior: (a) subjects who consistently did not participate in physical activity, (b) subjects who consistently did participate in physical activity, and (c) subjects who showed inconsistent sports behavior. In order to test for the positive effect of physical activity on life satisfaction, planned comparisons of the three groups' mean life satisfactions were performed (between-subjects design). The expectation was to find a positive relationship between increasing sports behavior and life satisfaction.

In order to infer causality and to test hypotheses 2B and 3B, an additional within-subjects design was implemented. A fourth group (d) was selected containing all participants who changed from not participating in sports to actively participating in sports within the considered time frame. For this group, mean life satisfaction during the inactive period was compared to mean life satisfaction during the active period. The expectation was to find a significant increase in life satisfaction after participants transitioned from not participating in sports to actively participating in sports (hypothesis 2B). Additionally it was expected that subjects' life satisfaction in the physically inactive period did not differ from life satisfaction of the non-sports group (group (a) above), and that subjects' life satisfaction in the physically active period did not deviate from the life satisfaction of the sports group (group (b) above). Finally, the development of life satisfaction over time was investigated and tested for exponential progression (hypothesis 3B).

As a basis for these analyses, a dummy variable "group" was computed based on the answering pattern to the question about participation in active sports. Group (a), the "non-sports group", includes participants who did not actively participate in sports in any of the considered years, i.e., responded "never" or "less often (than

at least once a month)" in all waves K trough P (N=3,991). Group (b), the "sports group", includes all respondents who actively participated in sports in all years, i.e., responded "at least once a week" or "at least once a month" in all waves K through P (N=1,016). Group (d), the "treatment group", consists of those individuals who were initially physically inactive, then at some point started reporting being physically active. Specifically, the treatment group consists of participants who did not participate in sports in waves K and L—i.e., responded "never" or "less often (than at least once a month)" in these waves—but actively participated in sports in waves M through P—i.e., responded "at least once a week" or "at least once a month" in these waves (N=55). Finally, group (c), the "inconsistent group", contains the remaining participants; these are participants who actively participated in sports in at least one year, but not in all years (N=4,188).

5.3   Results

The data analyses were carried out as described above. The results of the analysis are described in the following.

Hypothesis 1B: Positive effect of physical activity on subjective well-being (between-groups)

Planned comparisons based on a one-way ANOVA show an overall effect of actively participating in sports on life satisfaction (see appendix A.b). The three group means were significantly different from each other for all of the eight waves considered. The sports group consistently showed the highest average life satisfaction (mean of 0.51 for waves J through P), while the non-sports group consistently showed the lowest average life satisfaction (mean of -0.23 for waves J through P). Finally, the average life satisfaction for the inconsistent group ranged between the satisfaction levels of the other two groups (mean of 0.08 for waves J through P). See Figure 5-6 for average life satisfactions per group and wave.
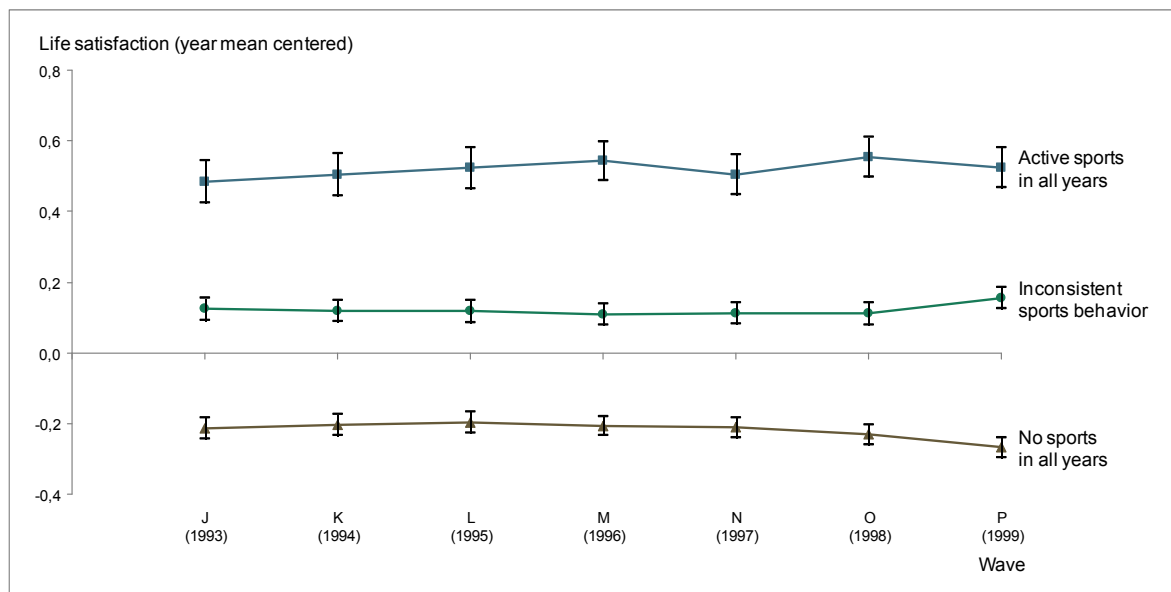
Figure 5-6   Mean life satisfaction (centered) per group

The life satisfaction of the sports group was significantly higher than the life satisfaction of both the non-sports group ($t(1898) = 17.53$, $p < .001$) and the inconsistent group ($t(1766) = 10.47$, $p < .001$). A comparison of the inconsistent group and the non-sports group shows that even inconsistent participation in sports leads to significantly higher life satisfaction than not participating in sports at all ($t(8093) = 10.05$, $p < .001$).

There is one alternative explanation that needs to be ruled out, namely that a third variable, *age*, potentially influences both the independent variable and the dependent variable. First, age possibly influences the group membership of the participants (independent variable): older people who tend to be physically less active have a higher probability of being in the non-sports group than in the sports group. Second, age can potentially have a negative influence on life satisfaction (dependent variable), since the burdens of old age—e.g., increased health risks (e.g., Kolberg, 1999) and psycho-social losses (e.g., Baltes & Mayer, 1999)—can reduce life satisfaction (Gerstorf et al., 2008; Schilling, 2006). Hence, age represents a possible confounding variable. A one-way ANOVA using planned comparisons

confirms that age influences group membership: the three groups differ signifi-
cantly with regards to age. The average age of the non-sports group (54 years) is
significantly higher than the average age of the inconsistent group (45 years;
$t(8134) = -25.78$, $p < .001$) and the sports group (43 years; $t(1754) = -21.80$, $p < .001$).
Also, the average age of the inconsistent group is significantly higher than the av-
erage age of the sports group ($t(1682) = -4.06$, $p < .001$).
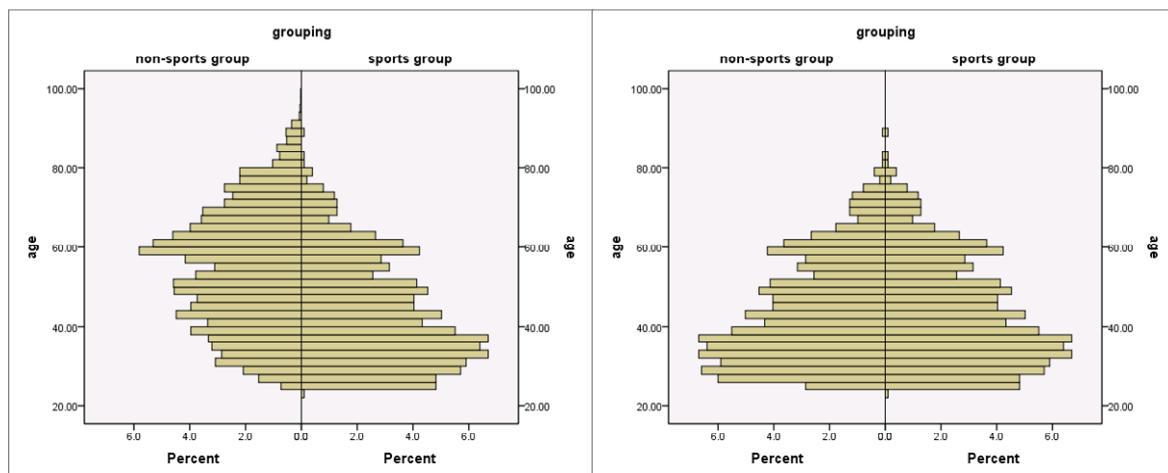
**Figure 5-7   Age distributions in the sports and non-sports group *before* (left) and
after (right) matching**

Since the preexisting groups differ regarding age, applying analysis of covariance
is not appropriate to control for this group difference (Lord, 1969; Miller & Chap-
man, 2001). Instead, the groups need to be matched by age to determine whether
the relationship between participating in sports and life satisfaction is confounded
by the influence of age. For this purpose, a propensity score matching
(D'Agostino, 1998; Rosenbaum & Rubin, 1983, 1984) was performed on the data.
The propensity score was calculated as the binary logistic regression with group as
the dependent variable and age as the covariate. This needed to be performed
twice: once for matching the inconsistent group to the sports group, and once for
matching the non-sports group to the sports group. Based on the propensity
scores, participants of the inconsistent group and the non-sports group were

matched to the participants of the sports group. The SPSS syntax for nearest neighbor propensity score matching as provided by Painter (2004) was implemented for this purpose. The resulting data contained three groups (sports, non-sports, and inconsistent group) of equal size (N=1,016), equal mean age (43 years), and equal age distributions. Figure 5-7 shows the age distributions of the non-sports group versus the sports group *before* and *after* the matching procedure.

Even after controlling for age, the significant effect of participating in sports on life satisfaction persists. Applying the same planned comparisons as before (see appendix A.c), the life satisfaction for the sports group was again significantly higher than the life satisfaction of both the non-sports group ($t(1957) = 12.50$, $p < .001$) and the inconsistent group ($t(1985) = 8.85$, $p < .001$). Also, the life satisfaction of the inconsistent group was again significantly higher than the life satisfaction of the non-sports group ($t(2026) = 3.63$, $p < .001$). Figure 5-8 compares means and standard deviations for the three groups before and after matching. Notably, the mean life satisfaction for the non-sports group increased from -0.23 to -0.19, which is in line with the hypothesized effect. However, mean life satisfaction for the inconsistent group declined from 0.08 to 0.03 and thus deviates from the hypothesized effect.

Descriptives

Before matching

Average life satisfaction waves J-P

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
non-sports group	3991	-.2301	1.42466	.02255	-.2743	-.1859	-6.81	3.19
inconsistent group	4188	.0786	1.34986	.02086	.0377	.1195	-6.67	3.19
sports group	1016	.5135	1.14504	.03592	.4430	.5840	-5.38	3.19
Total	9195	-.0073	1.38212	.01441	-.0356	.0209	-6.81	3.19

Descriptives

After matching

Average life satisfaction waves J-P

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
non-sports group	1016	-.1931	1.39204	.04367	-.2788	-.1075	-6.52	3.19
inconsistent group	1016	.0259	1.33149	.04177	-.0561	.1079	-5.38	2.90
sports group	1016	.5135	1.14504	.03592	.4430	.5840	-5.38	3.19
Total	3048	.1154	1.32668	.02403	.0683	.1625	-6.52	3.19

Figure 5-8   Group descriptives *before* and *after* matching

Hypothesis 2B: Positive effect of physical activity on subjective well-being (within-subjects)

Although age has been controlled for in the above analyses, no causal interpretations can be inferred at this point due to the lack of an intervention. A possible alternative explanation is a self-selection effect, i.e., happier people could have a higher likelihood of participating in sports. In order to substantiate the causality of the effect of physical activity on life satisfaction, it is necessary to perform a within-subjects analysis of subjects who change from being physically inactive to being physically active. For this purpose, a treatment group was defined (cf. chapter 5.2.3) including all 55 participants of the SOEP who did not participate in sports in waves K and L but actively participated in sports in waves M through P.

With regards to this treatment group, the following was hypothesized:

(1) In the physically inactive years, the life satisfaction of the treatment group is not significantly different from the life satisfaction of the inconsistent group (between-groups).

(2) In the physically active years, the life satisfaction of the treatment group is significantly higher than the life satisfaction of the inconsistent group (between-groups).

(3) In the physically active years, the life satisfaction of the treatment group is not significantly different from the life satisfaction of the sports group (between-groups).

(4) In the physically active years, the life satisfaction of the treatment group is significantly higher than the life satisfaction if the treatment group in the physically inactive years (within-subjects).

Since the treatment group is very small compared to the sports group or the inconsistent group, these two control groups needed to be matched and reduced in size in order to allow for meaningful between-group analyses (see Figure 5-9 for a plot of the between-group comparisons based on *unbalanced* sample sizes).
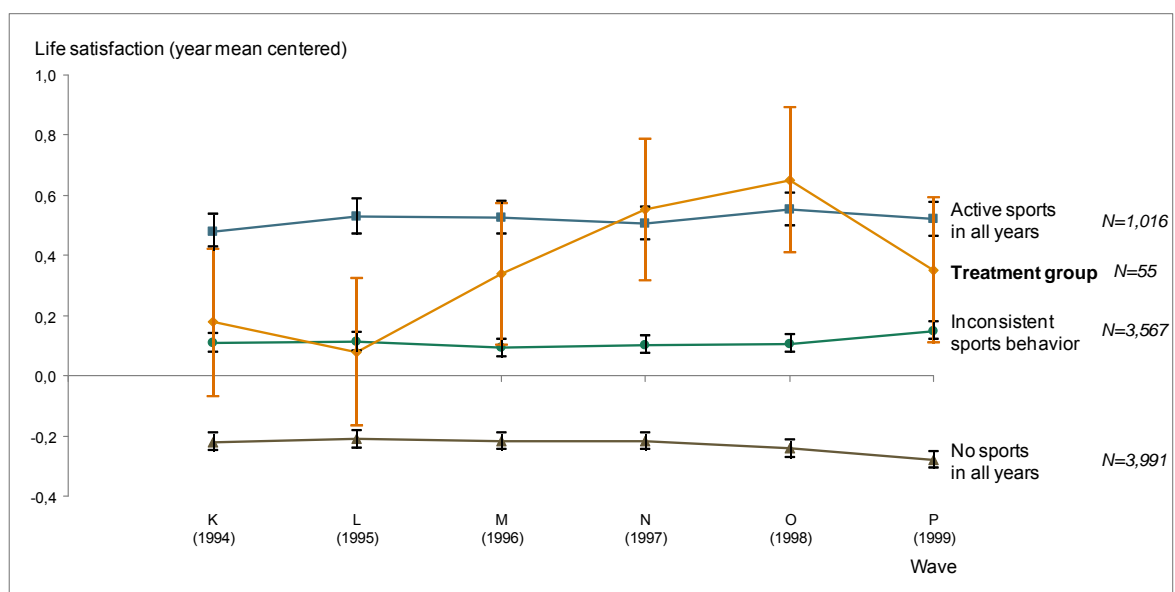
Figure 5-9   Between-groups comparison (unbalanced sample sizes)

Based on a propensity score matching, 55 participants from the inconsistent group and 55 participants from the sports group were matched to the 55 subjects in the treatment group. The propensity score was calculated based on the covariates age

and gender. As a result, each of the three groups comprises 22 male subjects and 33 female subjects and features a mean participant age of 44.4 years.

Due to the relatively small sample size of 55 subjects per group and an effect size that is expected to be medium to small (since life satisfaction is impacted by many variables besides physical activity), a significance level of $\alpha = .10$ is required in order to achieve satisfactory power of .80 (J. Cohen, 1992, p. 158). Thus assuming a significance level of 10%, all four sub-hypotheses are supported in the data. First, in the physically inactive years, the mean life satisfaction of the treatment group is not significantly different from the mean life satisfaction of the inconsistent group ($t(108) = .24$, ns). Second, in the physically active years, the life satisfaction of the treatment group is significantly higher than the life satisfaction of the inconsistent group ($t(108) = 1.57$, $p < .10$, one-tailed). Third, in the physically active years, the life satisfaction of the treatment group is not significantly different from the life satisfaction of the sports group ($t(108) = -0.19$, ns). Figure 5-10 provides a graphical representation of these three between-group comparisons.
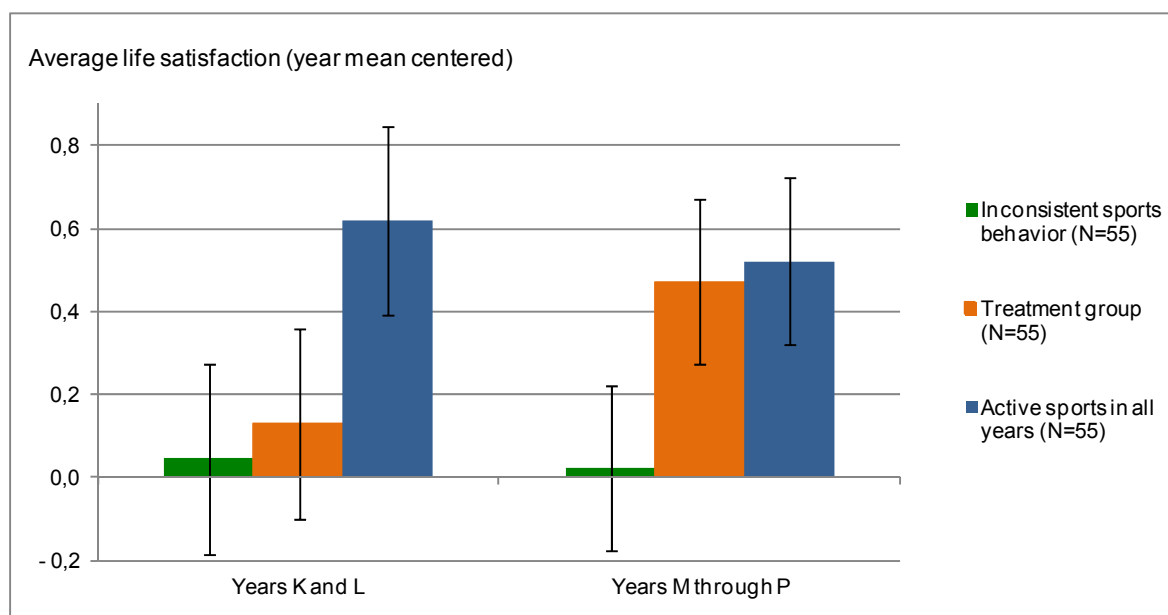
Figure 5-10   Between-groups comparison (balanced and matched samples)

Fourth, in the physically active years, the life satisfaction of the treatment group is significantly higher than the life satisfaction in the treatment group in the physically inactive years. The paired samples t-test reveals $t(54) = 1.58$, $p < .10$ (one-tailed). Figure 5-11 provides a graphical representation of the within-subjects effects of the treatment group and the two control groups. Table 5-1 summarizes the mean life satisfactions per considered group and time period (as depicted in Figure 5-10 and Figure 5-11), while Appendices A.d through A.h contain the statistical analyses in more detail.
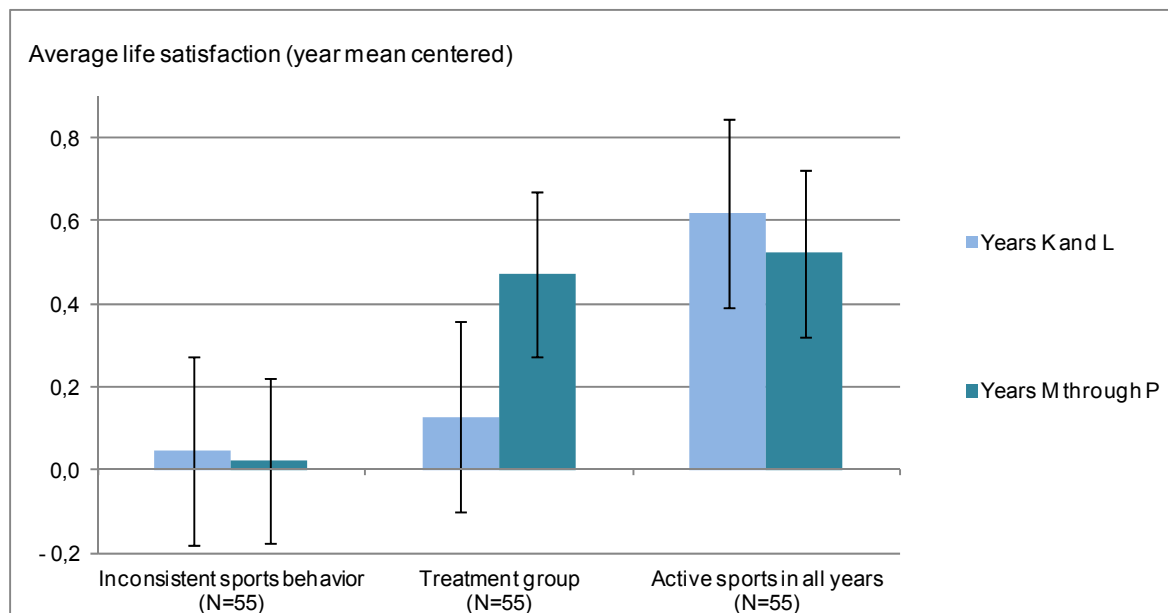
Figure 5-11   Within-subjects comparisons (balanced and matched samples)

Table 5-1   Mean life satisfactions per group and time

	Mean life satisfaction	
	years K and L	years M through P
Treatment group (N=55)	0,128	0,472
Inconsistent sports behavior (N=55)	0,046	0,022
Active sports in all years (N=55)	0,619	0,522

When considering the established effect, it is important to keep in mind both the small sample sizes and the expected small to medium magnitude of effects. The

statistical power thus tends to be low. On the other hand, the significance level has been fixed at .10, which means there is a 10% probability of the observed results arising by chance. Hence, the results should be regarded as initial trends that need to be confirmed using a larger sample. From this perspective it would be desirable that the SOEP or other extensive longitudinal studies included measures of the level of physical activity in all consecutive waves. Overall, however, the highly significant differences in life satisfaction among the sports, inconsistent and non-sports groups suggest that this finding is not an artifact, but may indeed be substantiated with larger sample sizes.

Hypothesis 3B: Curve progression of subjective well-being over time

The COR theory hypothesis that resource gains take an exponential curve progression is analyzed based on the within-subjects data of the treatment group (N=55). First, the curve progression of subjects' life satisfaction in wave L (last year without physical activity) through waves M to P (four years with physical activity) is tested on an exponential progression. The respective curve is depicted in Figure 5-12.
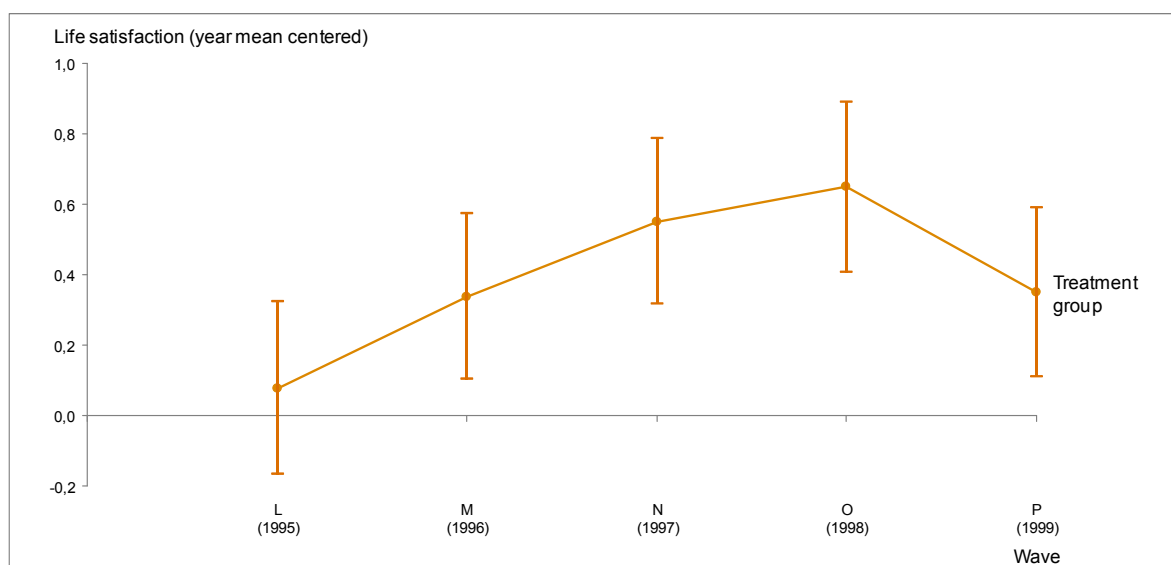
Figure 5-12   Curve progression of life satisfaction in treatment group

The only requirement postulated for the exponential progression is for the absolute growth to increase over time, such that the growth between waves L and M is positive but smaller than the growth between waves M and N, which is smaller than the growth between waves N and O, which finally is exceeded by the growth between waves O and P. However, a simple pre-investigation of the actual growth rates implies that an exponential progression cannot be substantiated: growth rates decrease over time (from 0.26 between waves L and M to 0.21 between waves M and N to 0.10 between waves N and O) and finally the growth between waves O and P is negative (-0.30).

In addition, a nonlinear regression was performed in order to attempt to fit an exponential curve to the data. The exponential curve was based on the general exponential function $f(x) = a + b \cdot e^{c \cdot x}$ where x describes the time in terms of the five waves. The parameter estimates for a, b, and c, which were obtained from the nonlinear regression, each had '0' in the bounds of their confidence intervals and thus cannot be assumed to be different from 0.
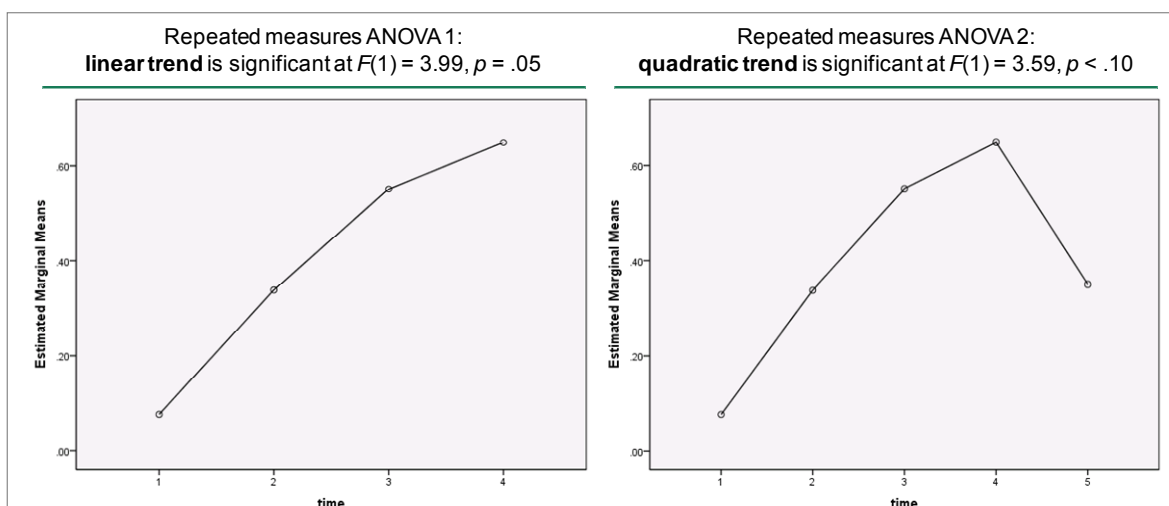
Figure 5-13   Linear and quadratic trends in the curve progression

Since the hypothesis of an exponential curve progression could not be confirmed, a repeated measures ANOVA was performed to test for *other possible curve shapes*

including linear, quadratic, and cubic. One ANOVA was calculated for waves L to O (four waves) and a second ANOVA for waves L to P (five waves). For both repeated measures ANOVAs, the test of within-subjects effects is not significant, revealing $F(2.166) = 2.24$, $p = .11$ respectively $F(2.83) = 1.67$, $p = .18$ (both results state the Greenhouse-Geisser correction due to violated sphericity assumptions). However, the first repeated measures ANOVA reveals a significant *linear trend* for waves L to O ($F(1) = 3.99$, $p = .05$), while the second repeated measures ANOVA reveals a significant *quadratic trend* for waves L to P ($F(1) = 3.59$, $p < .10$). The repeated measures ANOVA are documented in Appendices A.i and A.j; Figure 5-13 gives a graphical representation of the curve progressions. Overall, the data reveals a positive trend over time with the constraint that mean life satisfaction in the middle of the course is higher than at the end of the course.

As before, the results have to be considered cautiously due to the small sample size and small to medium effect size on the one hand, and the significance level of .10 on the other hand. Thus, the results should be interpreted as an initial trend that requires further substantiation.

6   Data set 2: Gym study

The second longitudinal study, in which the hypotheses formulated in chapter 4.4 were tested, was conducted specifically for this thesis. The study was conducted among people who signed up as new members of a fitness center, and thus will be referred to as the "gym study". The gym study is different from the SOEP study in two major dimensions. First, resources are measured in terms of the COR-E instead of using life satisfaction as a proxy. Secondly, the time lag between two measurements is shorter, considering resource changes on a three-week time-span as opposed to the yearly time-span of the SOEP.

6.1   Method

6.1.1   Measures

Dependent variable: Resource gains

The COR-E was employed to measure participants' resources (for a detailed description of the COR-E, see chapter 2.1.3). Before the COR-E could be used on a German sample, it had to be translated from English to German. An initial translation was validated by two native German speakers fluent in English; see Appendix B.b for the translations of all 74 resources.

In each wave of the study, participants were asked to indicate the degree of resource gains they had experienced in the past *three weeks*—i.e., since the last wave—for each of the resources. Resource gains were measured on a five-point Likert-scale ranging from "no gain or not applicable (0)" to "small gain (1)" to "large gain (4)" (see Appendix B.a for the exact instructions and scale labels). In order to prevent subjects from averaging their resource gains and losses, resource

losses on the identical resource items were evaluated separately—in succussion of the resource gains.

Table 6-1   Subset of 34 COR-E resources included in the questionnaires

#	Original resource item	German translation	Sport-related?*
1	Hope	Hoffnung	✔
2	Ability to organize tasks	Organisationsfähigkeit	
3	Intimacy with one or more family members	Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	
4	Sense of commitment	Engagement/Hingabe	✔
5	Stamina/endurance	Ausdauer/Geduld	
6	Feeling that I know who I am	Das Gefühl zu wissen wer ich bin	✔
7	Affection from others	Zuneigung von anderen	
8	Feeling that I have control over my life	Das Gefühl, dass ich Kontrolle über mein Leben habe	✔
9	Intimacy with at least one friend	Vertrautheit mit mindestens einem Freund / einer Freundin	
10	Self-discipline	Selbstdisziplin	✔
11	Time for adequate sleep	Zeit für ausreichend Schlaf	
12	Ability to communicate well	Kontaktfähigkeit	✔
13	Understanding from my employer/boss	Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef	
14	Time for work	Zeit für die Arbeit	
15	Feeling that my life has meaning or purpose	Das Gefühl, dass mein Leben Sinn/Bedeutung hat	
16	Involvement in organizations with others who have similar interests	Aktive Mitgliedschaft in Vereinen/ Organisationen mit Menschen, die meine Interessen teilen	✔
17	Positive feelings about myself	Positive Gefühle gegenüber mir selbst	✔
18	Companionship	Kameradschaft/Gemeinschaft/Gesellschaft	✔
19	Motivation to get things done	Motivation etw. anzupacken/ getan zu bekommen	✔
20	Knowing where I am going with my life	Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	
21	People I can learn from	Menschen von denen ich lernen kann	✔
22	Feeling independent	Das Gefühl unabhängig/selbstständig zu sein	✔
23	Time with loved ones	Zeit für gute Freunde, Familie und andere Nahestehende	
24	Personal health	Meine eigene Gesundheit	✔
25	Intimacy with spouse or partner	Vertrautheit/Intimität mit dem Partner	
26	Acknowledgement for accomplishment	Anerkennung für meine Leistungen	✔
27	Free time	Freizeit	
28	Feeling that I am accomplishing my goals	Das Gefühl, dass ich meine Ziele erreiche	✔
29	Feeling my future success depends on me	Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	✔
30	Positively challenging routine	Positiv fordernder/anregender Tagesablauf	✔
31	Feeling valuable to others	Das Gefühl für andere wichtig/wertvoll zu sein	✔
32	Sense of pride in myself	Das Gefühl auf mich stolz sein zu können	✔
33	Feeling that I am successful	Das Gefühl erfolgreich zu sein	✔
34	Sense of optimism	Optimismus	✔

*) based on the hypothesis formulated in chapter 4.2.3

In the study, only 34 of the 74 resource items proposed by the COR-E were administered. This is because the COR-E includes several resources that are relatively stable over short time periods (such as the three-week time-lag implemented in this study). To reduce its length and complexity, the questionnaire was limited to only those resource items that would be variable on a three-week time frame. To identify these variable resources, a *pretest* was conducted among 21 volunteers (eight women and twelve men aged between 23 and 49 with a mean age of 30.8 years). In two waves conducted with a time-lag of three weeks, the pretest subjects were asked to indicate their resource gains and losses using the same instructions,

scales, and online questionnaire tools as on the final sample. Appendix B.b describes the rationale for selecting 34 resources out of the 74 resources based on the results from the pretest. Table 6-1 lists the 34 selected resources, showing both the original English resource label and the German translation. Notably, the 22 resources that were hypothesized to be related to participating in physical activity (cf. chapter 4.2.3) are all included in the 34 resources and have also been identified in Table 6-1.

Control variables

Aside from age and gender, three control variables were collected: (1) a weekly activity score reflecting how intensely subjects had participated in physical activity in the past three weeks, (2) an exercise history indicating whether subjects had been physically active prior to joining the gym, and (3) the level of physical activity required in the subject's working environment.

The weekly activity was assessed using the Leisure-Time Exercise Questionnaire (LTEQ) (Godin & Shephard, 1985) in the German translation provided by (Lippke & Vögele, 2006). In the LTEQ, subjects are asked to indicate how many times per week they participate in (a) *strenuous exercise* in which the heart beats rapidly, e.g., running, jogging soccer, vigorous swimming, or vigorous long distance bicycling, (b) *moderate exercise* which is not exhausting, e.g., fast walking, easy bicycling, or easy swimming, (c) *mild exercise* which requires minimal effort, e.g., yoga, golf, easy walking, or fishing. The weekly frequencies of strenuous, moderate, and light activities are multiplied by nine, five, and three metabolic equivalents (MET) respectively. The sum of these products represents the weekly activity score (Godin & Shephard, 1997):

Weekly leisure activity = (9 × strenuous) + (5 × moderate) + (3 × light)

In each wave (except the first), the participants were asked to specify their weekly physical activity level over the past three weeks, i.e., since the last questionnaire. For each category (strenuous, moderate, and mild exercise), the subjects indicated (a) the frequency and (b) the average duration in minutes. See Appendix B.a for the exact wording of the question and the respective answer options. To account for individual differences in the duration of single units of physical activity (durations ranged between five minutes and 180 minutes), the frequencies were recalculated to represent the number of 30 minute exercise units performed. The distribution of the resulting weekly activity score is depicted in Figure 6-1.
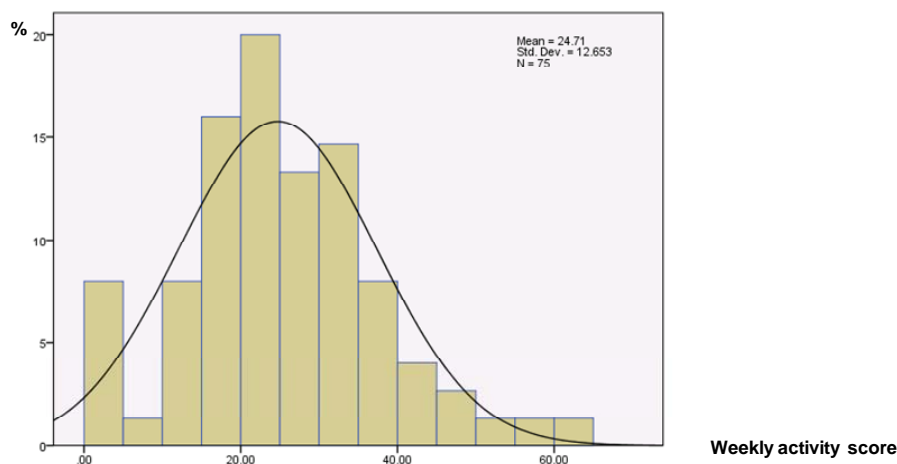
Figure 6-1   Histogram of the weekly activity score based on the LTEQ

To establish whether subjects had been physically active before joining the gym, in the first wave they were asked to indicate whether in the past six months they had (a) *not* participated in sport or exercise, (b) participated in sport or exercise, but *not on a regular basis*, (c) regularly participated in regular sport or exercise and started *within* the past six months, or (d) regularly participated in regular sport or exercise and had been doing so for *more* than six months. Subjects were required to choose exactly one of the four options.

Finally, subjects were asked to specify how much physical activity is required for their work: (a) primarily seated work, e.g., computer work, office work in general, or studying, (b) medium intensity physical activity, e.g., a crafts or sales position, or (c) intense physical activity, e.g., a mailman or construction worker. Again, subjects were required to choose exactly one answer.

6.1.2 Participants and procedure

A total of 72 potential participants were recruited from more than 30 gyms in 20 German cities. All of the gyms except one were branches of five major fitness studio chains; one fitness studio was independent. In the independent fitness studio and in one of the chain gyms, new members were approached by the staff and asked if they would like to participate in a scientific study regarding sport behavior. If the new members agreed, they wrote down their e-mail address and signed a form allowing the gym to share their data. In the remaining fitness studios, an invitation to participate in a scientific study regarding sport behavior was posted on the studios' Facebook pages (with the approval of the respective studios). Interested new members could then click on a link and submit their e-mail address, their fitness studio, and how many weeks they had been studio members (a maximum of six weeks was permitted). In all studios, an incentive (in the form of a raffle to win three months of free gym membership) was offered to attract participants.

Of the 72 potential participants who submitted their e-mail addresses, 45 fully completed the questionnaire in the first wave. Of these 45, 16 were men, 28 were women, and one participant did not indicate his or her gender. Participants were aged between 20 and 49 years, with a mean age of 29.3 years. Over time, a considerable number of participants dropped out of the study: of the 45 participants in wave one, 28 participated in wave two, 20 in wave three, 16 in wave four, and 12

in wave five. The participation of the 45 original subjects over time is documented in Appendix B.d.

After participants had provided their e-mail addresses, an e-mail was sent to them which briefly described the course of the study but did not reveal the question being investigated. The e-mail also included a link to an online questionnaire. The online questionnaire was built and hosted on "oFB – der OnlineFragebogen" on the server "SoSciSurvey.de". Using the oFB tools, a unique serial number was created for each participant to access the questionnaire and automatically sent to participants by e-mail. This serial number was re-used for all waves, which made it possible to identify the questionnaires belonging to a single subject. Meanwhile the subjects' identities remained anonymous, since the e-mails and serial numbers were computer-generated by the oFB tool set.

With a time-lag of three weeks, the subjects received e-mail invitations to the following waves. A total of five waves were administered.

It was critical for participants to start the first wave as soon as possible, in order to capture the effect of *newly* participating in physical activity. Since the participants were recruited gradually over time, the questioning was performed in several charges. The first questioning of the first charge occurred on June 19, 2011 and the first questioning of the last (seventh) charge on November 6, 2011.

6.1.3 Strategy of analysis

The overall sample size is too small to apply structural equation modeling or other rigorous statistical analyses to the data. Therefore, the analysis is restricted to the investigation of trends in the data. Clearly, any trend that is established from the present study needs to be rigorously confirmed on larger samples that allow for more robust statistical analyses.

In order to test for hypotheses one to three, the following strategy was applied. First, in order to test for a positive effect of physical activity on resources between-groups (hypothesis 1A), the resource gains of the gym sample were compared to the resource gains obtained in the pretest. Second, in order to test for a positive effect on resources within subjects (hypothesis 2A), the resource gains of the subjects in the gym sample were correlated with their respective weekly activity scores. Third, in order to test for an exponential progression of resource gains (hypothesis 3A), resource gains were inspected in their development over time. Additionally, the progression of the resource gains in the gym sample was compared to the progression in the pretest sample.

Furthermore, an exploratory factor analysis was performed in order to confirm the hypothesis elaborated in chapter 4.2.3, which theorized that 22 specific resources would be more immediately impacted by physical activity than the remaining resources.

6.2   Results

Hypothesis 1A: Positive effect of physical activity on resources (between-groups)

The 45 subjects in the first wave of the gym sample exhibit mean resource gains of 1.85 (standard deviation of 0.79) on the 34 measured resources. On a person-level, mean resource gains in the first wave ranged between a minimum of 0.26 and a maximum of 3.47, with a median of 1.74. On a resource-level, mean resource gains in the first wave ranged between a minimum of 1.22 (item "Menschen von denen ich lernen kann") and a maximum of 2.27 (item "Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt"), with a median of 1.87.

In contrast, the 21 subjects in the first wave of the pretest sample exhibit mean resource gains of only 1.19 (standard deviation of .78) on the identical 34 resources that were measured in the gym sample. On a person-level, mean resource gains in the first wave ranged between a minimum of .12 and a maximum of 2.53, with a median of 1.06. On a resource-level, mean resource gains in the first wave ranged between a minimum of .33 (item "Aktive Mitgliedschaft in Vereinen/Organisationen mit Menschen, die meine Interessen teilen") and a maximum of 1.76 (item "Das Gefühl für andere wichtig/wertvoll zu sein), with a median of 1.17.
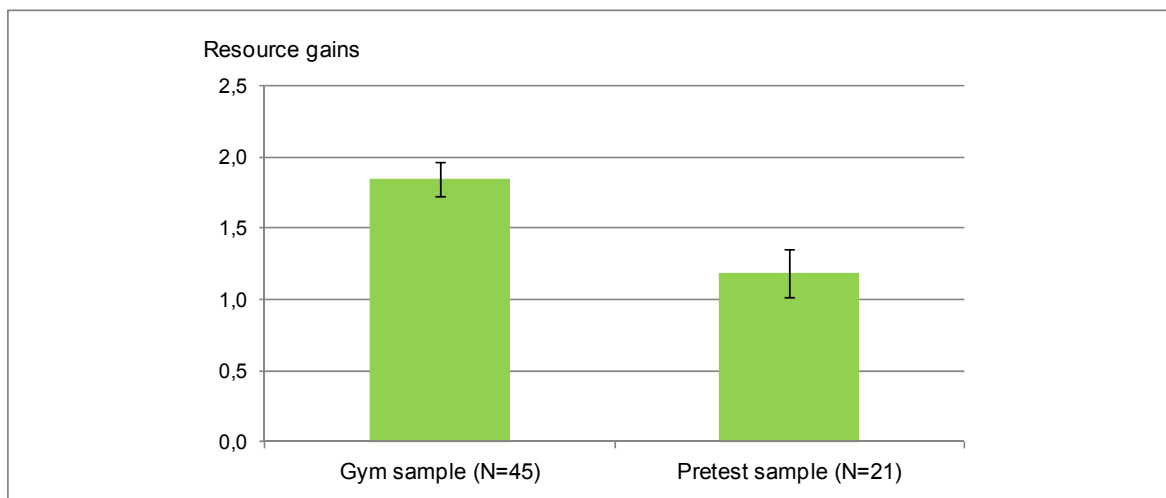
Figure 6-2   Mean resource gains in the first waves of the gym and pretest samples

Figure 6-2 graphically compares the mean resource gains for the two samples. An independent samples t-test (see Appendix B.e) confirms that the resource gains in the gym sample are significantly higher than the resource gains in the pretest sample: $t(64) = 3.17$, $p < .01$ (both one- and two-tailed).

On a resource-level, Table 6-2 lists the mean resource gains per resource item in waves one of the gym sample and the pretest sample. Additionally, it reports the mean distance between the samples per resource item. The table is ordered by this

distance in descending order, such that the resource items in which the two samples differ most are listed in the top.

Table 6-2   Mean gains per resource item for gym and pretest samples, ordered by distance (descending)

#	Resource item description	Mean gains (wave 1)		
		Gym sample	Pretest sample	Distance (Gym-pretest)
16	Aktive Mitgliedschaft in Vereinen/Organisationen mit Menschen, die meine Interessen teilen	1,69	0,33	1,36
11	Zeit für ausreichend Schlaf	1,67	0,43	1,24
24	Meine eigene Gesundheit	2,16	1,00	1,16
34	Optimismus	2,18	1,14	1,03
8	Das Gefühl, dass ich Kontrolle über mein Leben habe	2,02	1,00	1,02
10	Selbstdisziplin	2,11	1,10	1,02
12	Kontaktfähigkeit	1,98	1,00	0,98
17	Positive Gefühle gegenüber mir selbst	2,20	1,24	0,96
5	Ausdauer/Geduld	1,96	1,00	0,96
27	Freizeit	1,78	0,86	0,92
29	Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	2,27	1,38	0,89
1	Hoffnung	2,07	1,19	0,88
7	Zuneigung von anderen	2,13	1,29	0,85
19	Motivation etw. anzupacken/ getan zu bekommen	2,20	1,38	0,82
18	Kameradschaft/Gemeinschaft/Gesellschaft	1,89	1,10	0,79
23	Zeit für gute Freunde, Familie und andere Nahestehende	1,82	1,10	0,73
22	Das Gefühl unabhängig/selbstständig zu sein	1,87	1,14	0,72
3	Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	1,76	1,05	0,71
6	Das Gefühl zu wissen wer ich bin	1,73	1,10	0,64
4	Engagement/Hingabe	1,84	1,29	0,56
15	Das Gefühl, dass mein Leben Sinn/Bedeutung hat	1,73	1,19	0,54
2	Organisationsfähigkeit	1,87	1,33	0,53
14	Zeit für die Arbeit	1,51	1,00	0,51
30	Positiv fordernder/anregender Tagesablauf	1,91	1,43	0,48
20	Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	2,00	1,52	0,48
28	Das Gefühl, dass ich meine Ziele erreiche	1,78	1,33	0,44
9	Vertrautheit mit mindestens einem Freund / einer Freundin	2,07	1,71	0,35
13	Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef	1,24	0,90	0,34
32	Das Gefühl auf mich stolz sein zu können	1,98	1,67	0,31
21	Menschen von denen ich lernen kann	1,22	1,05	0,17
26	Anerkennung für meine Leistungen	1,64	1,52	0,12
25	Vertrautheit/Intimität mit dem Partner	1,24	1,29	-0,04
33	Das Gefühl erfolgreich zu sein	1,62	1,67	-0,04
31	Das Gefühl für andere wichtig/wertvoll zu sein	1,67	1,76	-0,10

Hypothesis 2A: Positive effect of physical activity on resources (within-subjects)

In the gym sample, three control variables were hypothesized to be meaningful for the analysis: exercise history, level of physical activity at work, and sport intensity. The following hypotheses were investigated:

   (1) Subjects who were physically inactive in the six month prior to the study are hypothesized to show larger resource gains than subjects who were already physically active when they joined the gym.

   (2) Subjects whose work involves little or no physical activity are hypothesized to show larger resource gains than subjects whose work involves moderate or intensive physical activity.

   (3) The subjects' sports intensity between two waves (measured as the weekly activity score) is hypothesized to be positively associated with the resource gains reported in the latter wave.

Only the third hypothesis could be confirmed: the correlation between weekly activity scores and resource gains (across waves 2 through 5) was in the hypothesized direction and significant: $r = .234$, $p < .05$ (both one- and two-tailed). Hypotheses one and two could not be confirmed. The correlation between prior physical activity level (ranging from 1 = no regular physical activity through 4 = regular sport for longer than the six past months) and resource gains in wave 1 is in the assumed direction but far from significant: $r = -.066$, $p = .668$. Similarly, the correlation between physical activity at work (ranging from 1 = sitting activity through 3 = intensive physical activity) and resource gains in wave 1 is in the assumed direction but also far from significant: $r = -.037$, $p = .811$.

Exploratory factor analysis

A principal components analysis (PCA) was conducted on the 34 resource items based on the resource gains in the first wave. An oblique rotation (promax) was chosen since the evolving factors were expected to be related rather than orthogonal. The Kaiser-Meyer-Olkin measure verified that the sample size is adequate for factor analysis with KMO = .69, which is a mediocre to good value (Field, 2009). Bartlett's test of sphericity was highly significant and thus indicated that correlations between items were sufficiently large for PCA.

The PCA based on an "eigenvalues greater one" extraction rationale returned an eight-factors solution, which explained a cumulative variance of 74.5%. This result is in line with Hobfoll et al. (1992), who find five and six factors in two different

samples and infer that participants view their gains and losses in discrete categories rather than globally (cf. chapter 2.1.3).

To test the hypothesis on resources that would be more directly impacted by physical activity versus resources that would be only indirectly impacted, a two-factor solution was required. Thus in the following it was specified that SPSS extract only two factors. The resulting two-factor solution explained a cumulative variance of 46%. Table 6-3 shows the factor loadings in the pattern matrix ordered by component size. With one exception, all factor loadings are greater than .30, and a majority of resources have factor loadings greater .50. Cross-loadings were acceptable, i.e., the delta between loadings on factors one and two was > .20; two exceptions are the items "Meine eigene Gesundheit" and "Das Gefühl für andere wichtig/wertvoll zu sein", which load on both factors with less than .20 distance.

The resource items that cluster on the same component suggest that component 1 represents the resources directly impacted by physical activity, i.e., *sport-related resources*, and component 2 represents *other resources* that are not directly related to sports. Thus, the factor structure largely supports the selection of resources from the COR-E that were previously hypothesized to be associated with regular physical activity (refer to chapter 4.2.3 or Table 6-1). Taking a bottom-up perspective, of the 22 resources postulated to be affected by physical activity (see items highlighted grey in Table 6-3), 18 are associated with component 1 and thus agree with the hypothesis, and four factors are associated with component 2 and thus are opposed to the hypothesis. Notably, three of these four deviating items refer to the social aspects of physical activity ("Kontaktfähigkeit", "Kameradschaft", "Das Gefühl für andere wichtig/wertvoll zu sein"); in line with this finding it could be argued that going to the gym may involve less social aspects than other types of physical activity, especially those performed in groups or teams. Taking a top-down perspective, all but two of the 20 resource items associated with compo-

nent 1 are items that have been hypothesized to be related to physical activity; the two additional resource items loading on this component are "Das Gefühl, dass mein Leben Sinn/Bedeutung hat" and "Organisationsfähigkeit".

Table 6-3   **Pattern matrix for principal component analyses on resource gains in wave one (showing only coefficients with absolute value >.2)**

		Resource gains	
		Sport-related resources	Other resources
10	Selbstdisziplin	**,92**	-,28
5	Ausdauer/Geduld	**,82**	
32	Das Gefühl auf mich stolz sein zu können	**,81**	
28	Das Gefühl, dass ich meine Ziele erreiche	**,81**	
34	Optimismus	**,80**	
33	Das Gefühl erfolgreich zu sein	**,73**	
1	Hoffnung	**,72**	-,34
8	Das Gefühl, dass ich Kontrolle über mein Leben habe	**,71**	
15	Das Gefühl, dass mein Leben Sinn/Bedeutung hat	**,70**	
29	Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	**,69**	
19	Motivation etw. anzupacken/getan zu bekommen	**,68**	
30	Positiv fordernder/anregender Tagesablauf	**,65**	
4	Engagement/Hingabe	**,61**	
17	Positive Gefühle gegenüber mir selbst	**,59**	,22
6	Das Gefühl zu wissen wer ich bin	**,59**	
21	Menschen von denen ich lernen kann	**,49**	
24	Meine eigene Gesundheit	**,47**	,31
26	Anerkennung für meine Leistungen	**,44**	,20
2	Organisationsfähigkeit	**,43**	,23
16	Aktive Mitgliedschaft in Vereinen/Organisationen mit Menschen, die meine Interessen teilen	**,41**	
9	Vertrautheit mit mindestens einem Freund / einer Freundin	-,25	**,86**
23	Zeit für gute Freunde, Familie und andere Nahestehende		**,82**
18	Kameradschaft/Gemeinschaft/Gesellschaft		**,82**
14	Zeit für die Arbeit		**,78**
27	Freizeit	-,23	**,72**
3	Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern		**,62**
7	Zuneigung von anderen		**,62**
22	Das Gefühl unabhängig/selbstständig zu sein	,25	**,57**
20	Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	,31	**,56**
12	Kontaktfähigkeit		**,52**
31	Das Gefühl für andere wichtig/wertvoll zu sein	,39	**,49**
25	Vertrautheit/Intimität mit dem Partner		**,43**
11	Zeit für ausreichend Schlaf		**,41**
13	Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef		**,36**

Notably, there is an alternative interpretation of components 1 and 2. Instead of sports-related resources, component 1 could be considered to represent resources that are *personal characteristics*; instead of other resources, component 2 could be seen as resources that are *conditions or energy resources*. Specifically, component 1 comprises self-conceptions such as the feeling of being successful, the feeling of

having control over one's life, and the feeling that life has meaning, as well as characteristics such as having hope, being optimistic, and having motivation to get things done. In contrast, component 2 consists of the time-related energy resources such as having time for work, for friends and family, and for leisure, as well as conditions such as having the affection of others and having at least one intimate friend.

Hypothesis 3A: Curve progression of resource gains

In each of the five waves, the subjects exhibit resource gains (see left-hand side of Figure 6-3 or grand means of Table 6-4). Thus, over time, the subjects' *absolute* resources increase level-wise, fulfilling the second condition for gain spirals.
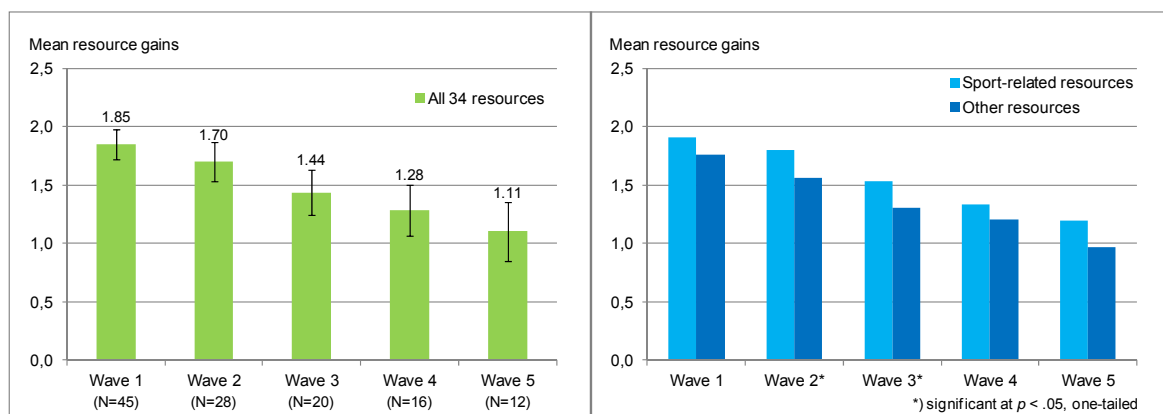
Figure 6-3   Progression of resource gains over time

However, the resource *gains* do not grow stronger over time, but rather show a decreasing trend from mean resource gains of 1.85 in wave one to mean resources gains of 1.11 in wave five. Since a necessary prerequisite of an exponential curve progression is increasing resource gains over time, the data rules out the possibility of an exponential progression of resources over time.

Also, when considering resource gains on an item level, no extreme outliers or deviators can be found—i.e., the resource gains of all 34 resources exhibit a similar

declining slope (see Figure 6-4 and Table 6-4). Separating the 34 resources into the two factors resulting from the above EFA—i.e., 20 sport-related resources and 14 other resources—also reveals the same declining pattern over time for both resource factors (see the right-hand side of Figure 6-3).

Table 6-4   Mean gains per resource item and wave

#	Resource item description	Mean resource gains per wave				
		Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
1	Hoffnung	2,07	1,57	1,55	1,69	1,33
2	Organisationsfähigkeit	1,87	1,79	1,85	1,69	1,67
3	Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	1,76	2,04	1,50	1,50	1,17
4	Engagement/Hingabe	1,84	1,82	1,35	1,25	0,92
5	Ausdauer/Geduld	1,96	1,86	1,90	1,50	1,00
6	Das Gefühl zu wissen wer ich bin	1,73	1,71	1,90	1,25	1,42
7	Zuneigung von anderen	2,13	1,71	1,70	1,31	1,50
8	Das Gefühl, dass ich Kontrolle über mein Leben habe	2,02	2,25	1,55	1,56	1,42
9	Vertrautheit mit mindestens einem Freund / einer Freundin	2,07	1,96	1,35	1,94	1,50
10	Selbstdisziplin	2,11	2,07	1,55	1,38	1,67
11	Zeit für ausreichend Schlaf	1,67	1,50	1,60	1,06	0,75
12	Kontaktfähigkeit	1,98	1,71	1,55	1,38	1,50
13	Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef	1,24	1,29	0,80	1,44	0,75
14	Zeit für die Arbeit	1,51	1,18	0,90	0,81	0,67
15	Das Gefühl, dass mein Leben Sinn/Bedeutung hat	1,73	1,21	1,25	1,25	0,83
16	Aktive Mitgliedschaft in Vereinen/Organisationen mit Menschen, die meine Interessen teilen	1,69	1,43	1,00	0,69	0,42
17	Positive Gefühle gegenüber mir selbst	2,20	1,82	1,55	1,13	1,33
18	Kameradschaft/Gemeinschaft/Gesellschaft	1,89	1,29	1,30	1,31	0,92
19	Motivation etw. anzupacken/ getan zu bekommen	2,20	1,96	1,55	1,56	1,17
20	Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	2,00	1,61	1,25	1,06	0,92
21	Menschen von denen ich lernen kann	1,22	1,57	1,10	1,13	1,00
22	Das Gefühl unabhängig/selbstständig zu sein	1,87	1,71	1,30	1,06	1,08
23	Zeit für gute Freunde, Familie und andere Nahestehende	1,82	1,39	1,25	1,50	0,67
24	Meine eigene Gesundheit	2,16	1,93	1,70	1,56	1,17
25	Vertrautheit/Intimität mit dem Partner	1,24	1,39	1,10	0,13	0,67
26	Anerkennung für meine Leistungen	1,64	1,79	1,45	1,13	0,92
27	Freizeit	1,78	1,46	1,20	1,19	0,33
28	Das Gefühl, dass ich meine Ziele erreiche	1,78	1,54	1,25	1,56	1,17
29	Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	2,27	2,04	2,00	1,31	1,50
30	Positiv fordernder/anregender Tagesablauf	1,91	1,89	1,45	1,19	1,17
31	Das Gefühl für andere wichtig/wertvoll zu sein	1,67	1,57	1,40	1,19	1,17
32	Das Gefühl auf mich stolz sein zu können	1,98	2,04	1,60	1,38	1,33
33	Das Gefühl erfolgreich zu sein	1,62	1,86	1,30	1,25	1,17
34	Optimismus	2,18	1,79	1,85	1,25	1,42
	Grand means	**1,85**	**1,70**	**1,44**	**1,28**	**1,11**

It is noteworthy, however, that the resource gains on the sport-related resources consistently exceed the gains on the other resources (also see right-hand side of Figure 6-3). For waves two and three, the gains on the sport-related resources are *significantly* greater than the gains on the other resources ($t(27) = 2.195$, $p < .05$, one-tailed, respectively $t(19) = 1.826$, $p < .05$, one-tailed); for waves one, four, and five this is not significant.
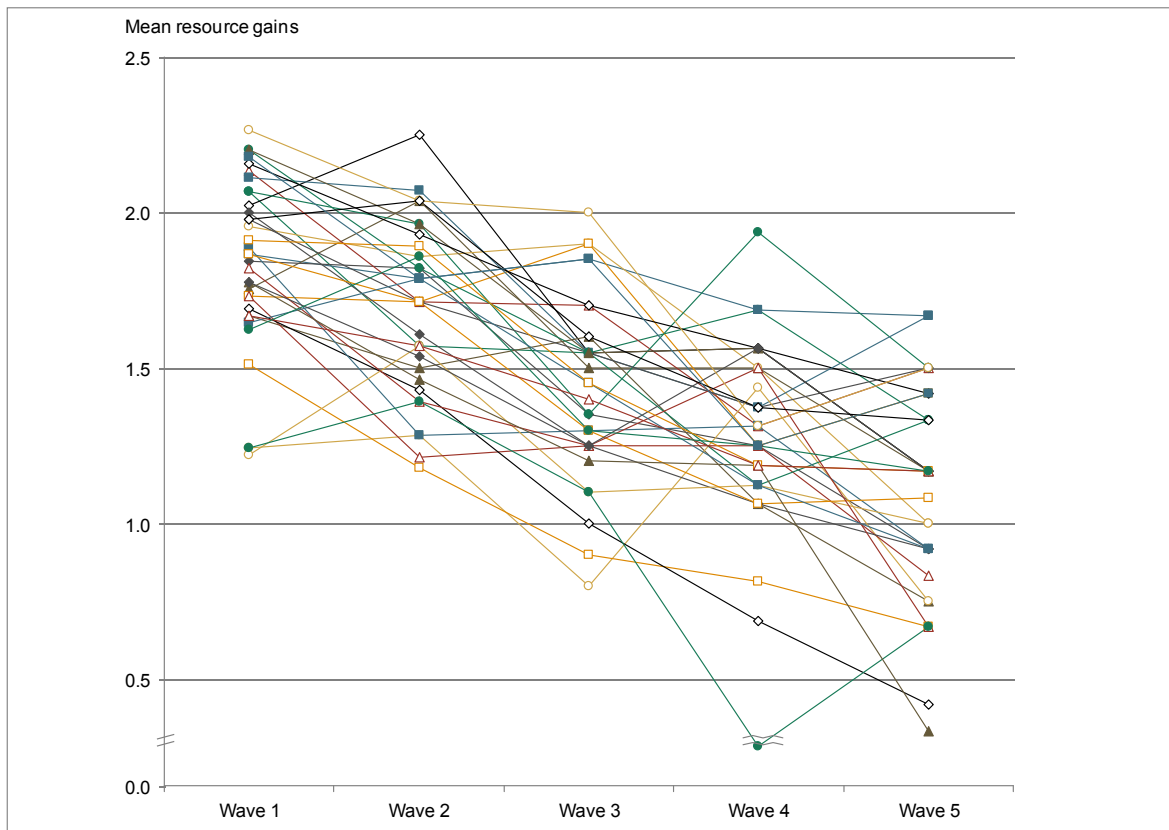
Figure 6-4   Curve progressions of mean resource gains per resource item

Finally, it should also be noted that the resource gains in the pretest, which involved two waves, also showed a declining trend. Mean resource gains in wave two were 0.66, which is significantly lower than mean resource gains of 1.19 in wave one: $t(12) = 4.662$, $p < .01$ (both one- and two-tailed). It could be inferred that the COR-E measurement instrument applied to repeated measurement designs is subject to a systematic bias. Again, however, the sample size of both the gym study and the pretest are too small to derive reliable inferences without replicating these findings.

7 Discussion of results

The major finding of the review of existing empirical evidence on gain spirals was that the first condition of gain spirals—i.e., correlational structures among resources over time—had been repeatedly confirmed, but to date no study had also reported level-wise increases over time. Therefore, the ultimate goal of the analyses in this thesis was to confirm the *second condition of gain spirals*, i.e., to substantiate level-wise increases of resources over time following an initial resource gain intervention.

For the intervention that should trigger initial resource gains, physical activity was selected. It was hypothesized that *physical activity* would have a notable and broad effect on resources; thus, having subjects start to actively participate in physical activity would be a meaningful intervention. Notably, this was the first time that physical activity was tested as an intervention for resources as defined by COR theory.

To improve the informative value and generalizability of any findings, the effect of newly participating in physical activity on resources was investigated in two separate studies. The studies differed primarily regarding the operationalization of resources and the considered time-lag. In the *SOEP study*, resources were approximated by subjective well-being in terms of life satisfaction, and the time-lags between assessments were one year. The *gym study*, in contrast, measured resources based on the COR-E and implemented time-lags of only three weeks. The SOEP data offered the additional advantage of being a professional longitudinal panel that has been running for over 25 years and has been the subject of a lot of research attention. The subjective well-being measure, in particular, has been utilized in many previous studies.

A second aim was to investigate the *development of resource gains*—once initiated—over time. Specifically, COR theory suggests an exponential curve progression for resource gains—an assumption which has been identified as questionable previously in this thesis, but should be tested nonetheless. With few exceptions, most previous studies had only investigated two waves, and thus did not allow inference of a curve progression of resource gains. The SOEP study, on the other hand, provided data on six consecutive waves—two waves prior to the intervention and four waves following the intervention—and the gym study comprised five post-intervention waves.

A secondary objective was to apply the *COR-E* to gain spiral research for the first time. Previous gain spiral research had measured up to a maximum of only eight resources, and these were furthermore not drawn from the COR-E. In contrast, the gym study administered 34 resources, representing a subset of the 74 COR-E resources.

In summary, the results of the respective analyses suggest that physical activity does have the hypothesized positive effect on resources, both in terms of subjective well-being and COR-E resources. However, the data cannot confirm level-wise increases of resources over time. The data revealed neither an exponential growth nor an asymptotic or linear growth in either subjective well-being or COR-E resources. In addition, the results indicate that there may be measurement issues when using the COR-E in a longitudinal design. In the following, these findings will be discussed and limitations of the two studies as well as directions for future research will be pointed out.

Physical activity has a positive effect on resources

The positive effect of physical activity on resources was confirmed both for resources approximated by life satisfaction (as in the SOEP study) and for resources measured based on the COR-E (as in the gym study). An analysis of the SOEP sample revealed that people who consistently participate in regular physical activity exhibit significantly higher life satisfaction than people who participate in regular physical activity either not at all or only inconsistently. This finding is based on large sample sizes of more than 1,000 subjects per group that have been matched for age and gender. Thus, the second condition of gain spirals, i.e. that absolute resource levels increase over time, could be substantiated.

In order to rule out alternative explanations for this finding—such as a third variable, e.g., extraversion, that could have a positive effect on both sport participation and life satisfaction—and thus allow for causal interpretations, the analyses were extended to the treatment group. Again, findings were consistent with the hypotheses, showing that (a) subjects' life satisfaction significantly increased when going from being physically inactive to being physically active, while (b) when being physically inactive, subjects' life satisfaction was equal to the life satisfaction of inconsistently physically active subjects, and (c) physically active subjects' life satisfaction was equal to that of consistently physically active subjects. These findings are based on smaller sample sizes of N=55 per group with groups matched for age and gender.

In the gym sample, using mean gains on 34 resources as dependent variable, these findings could be confirmed: mean resource gains in the first wave of the gym study were significantly larger than mean resource gains in the first wave of the pretest. Furthermore, the results showed that the frequency, duration, and intensity of physical activity were significantly and positively correlated with resource

gains. However, the hypothesized relationships (a) between exercise history and resource gains and (b) between the level of physical activity required at work and resource gains could not be substantiated.

Additionally, an EFA confirmed that the 34 measured resources could be meaningfully separated into resources that were more versus less directly impacted by physical activity. The two-factor solution suggested that 20 specific resources (e.g., motivation, optimism, or the feeling to be successful) are directly related to participating in physical activity, while another 14 specific resources (e.g., time for work or affection from others) are not or indirectly impacted. This finding largely confirms the hypothesis that resources are directly impacted by physical activity. The major deviation was that three resources related to social aspects of participating in sports, which had been hypothesized to be directly affected by physical activity, did not load on the first factor. As an explanation, it was proposed that there may be a qualitative difference (regarding the social aspect of sports) between exercising in a fitness studio and other modes of participating in sports, such as group or team sports. It thus appears plausible that going to the gym does not necessarily impact social resources.

Initial resource gains do not *show a self-sustaining effect*

The hypothesis that resources gains continue to increase over time could not be confirmed in either data set. In particular, the assumption that resource gains would take an exponential progression was falsified based on the considered data. In the treatment group of the SOEP study, initial gains in life satisfaction continued over two more waves, showing linear growth, but life satisfaction then declines in the fourth and final wave. Thus, the growth over the entire four-wave period exhibits a quadratic trend.

Since no observations for the following waves were available, it is, however, not possible to follow the trend any further. Thus it cannot be determined whether (a) the decline in the final wave is an outlier, and life satisfaction in reality stabilizes at the consistently high levels shown by the sportive group; or (b) the decline in the final wave marks the start of a downward trend, and life satisfaction even returns to the initial pre-sports level. This latter pattern would be in line with the hedonic treadmill and set-point theories that have been critically discussed in chapter 4.3.1. Clearly, additional observations are needed in order to clarify this ambiguity. Nonetheless, the fact that life satisfaction in the group that consistently participated in physical activity is invariably high gives reason to prefer the former explanation, namely that the decline in the final wave was merely an outlier rather than a continuing downwards trend.

Assuming that the decline indeed represents an outlier, then life satisfaction in the treatment group shows a linear growth. On the other hand, it is unlikely that the life satisfaction in the treatment group would continue to grow at a linear rate and thus grow *beyond* the life satisfaction exhibited by the subjects who consistently participated in physical activity throughout the study. Besides, a linear growth would have to halt, reverse, or turn into an asymptotic growth at some point, simply because the life satisfaction measurement instrument has an upper limit of 10 points—and mean life satisfaction for the sports group already ranged high at 7.2 to 7.4. In any case, the exponential growth suggested by COR theory could not be confirmed since it was impossible to fit an *exponential* growth curve to the data.

In the gym study, resource gains show a decreasing trend over time. However, for resources to grow exponentially, resource gains would have to increase over time. Thus the second data set also falsifies the hypothesis that resources, once initial gains have been triggered, grow exponentially. Rather, the data suggests that resource gains decrease and thus that the *absolute* resource level shows an asymptot-

ic growth curve. In other words, initial resource gains caused by new participation in physical activity cause an individual's absolute resource level to increase—but instead of being self-sustaining, this initial increase flattens out over time. This perception is congruent with the above discussion of the SOEP findings that the life satisfaction of the treatment group is likely stabilizing at the level of the sports-group.
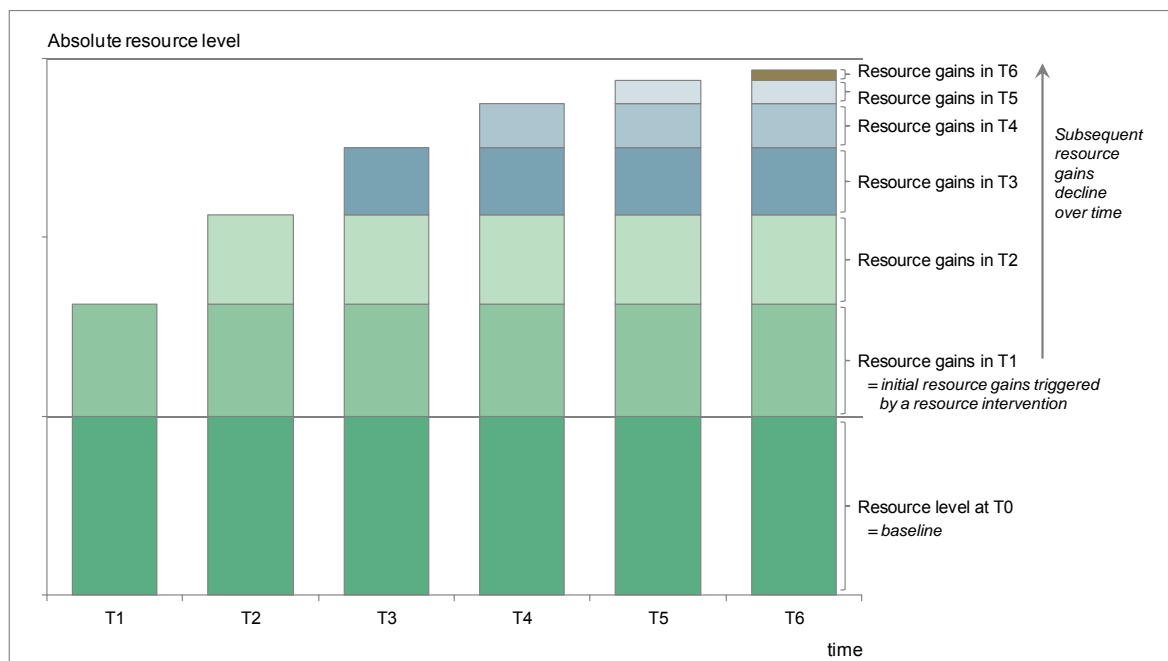
Figure 7-1   A proposed model of asymptotical resource growth

Thus, the findings on the curve progression of resources over time are consistent in both samples. Drawing on the insights of both the SOEP data and the gym data, the hypothesis of an exponential growth curve needs to be rejected and replaced by the hypothesis of an asymptotic growth curve. The asymptotic growth curve is reconcilable with both (a) the SOEP data, which shows a linear growth of life satisfaction in the treatment group that is assumed to gradually converge with the level of life satisfaction shown by the sports group, and (b) the gym data, which exhibits decreasing resource growth over time. Figure 7-1 provides a graphical representation of the proposed model of asymptotical resource growth.

Potential measurement issues when using the COR-E in a longitudinal design

When interpreting the data as suggested above, it needs to be considered that the COR-E measurement instrument has not yet been soundly tested in longitudinal research settings. Thus, in the gym study, biases related to the measurement instrument cannot be ruled out with certainty. Indeed, there is an indication that longitudinal COR-E results might be biased by a learning effect or halo effect, since resource gains in the pretest group of the gym study significantly decline from wave one to wave two. This result is counter-intuitive, since it would have been expected that resource gains in a random sample that did not obtain a systematic resource intervention remain constant over time. Based on the data of the pretest, it could be inferred that the COR-E measurement instrument is subject to some sort of halo effect in the first wave. When first asked about their resources, participants become suddenly more aware of their resources and mentally review their past weeks for evidence of respective gains; as a result, they may overestimate their resource gains. In subsequent waves, participants have become more familiar with the task of reflecting on their resource gains and estimate their resource gains more moderately; they have thus "learned" to respond to the COR-E. Notably, the sample size of the pretest is too small to reliably infer that the COR-E is biased by systematic measurement effects. However, solidly testing the validity and reliability of the COR-E measurement instrument in longitudinal research designs is an important task for further studies.

If such a learning effect were substantiated for the COR-E, the findings of the gym study would have to be adjusted accordingly. Specifically, the resource gains in the first wave could be artificially high because subjects may have overestimated their resource gains at the first point of measurement. As a consequence, the decline in resource gains between waves one and two could also be artificially elevated as a result of the learning effect between the two measurement times. It

could thus be argued that the resource gains in the two initial waves may, in reality, be similar.

Limitations

The major methodological limitation of the two presented studies relate to the small *sample sizes* of both the treatment group in the SOEP study and the panel of the gym study. It has therefore been clearly stressed that any inferences drawn from the data can only be regarded as trends that need to be verified in similar research designs using larger samples. Nonetheless, it is valuable and economical to investigate trends in smaller samples and to use the resulting insights to facilitate the formulation of hypotheses for future research in larger samples. In addition, the positive and highly significant effect of physical activity on resources (approximated by life satisfaction) could be robustly established in a large sample size (N > 1,000) and using control groups matched on age and gender.

The gym study, furthermore, did not include a proper *control group*, which is a second methodological limitation. Although resource gains in the gym panel have been compared to resource gains in the pretest panel, the pretest sample is not a perfect control group; for one, it was smaller than the gym sample, and for another, subjects were asked to specify their resource gains on all 74 resources of the COR-E, instead of on the subset of 34 resources reported by the gym sample. This limitation is mediated to some extent by the fact that the findings in the gym study show the same trends as the findings in the SOEP study—which is methodologically, and particularly in terms of the control groups, more robust.

As a third limitation, both studies are quasi-experimental rather than experimental, since randomization is not applied in either case. In the SOEP study, participants self-selected into the treatment group by regularly participating in physi-

cal activity in certain years, while in the gym study participants self-selected into the panel by joining a gym and being willing to participate in a scientific study. Thus, both samples are prone to a self-selection bias. In the SOEP study a scenario could be imagined where persons high on extraversion and/or low on neuroticism are more likely to participate in physical activity, thus biasing the self-selection into the treatment group, while high extraversion and low neuroticism are also associated with higher levels of life satisfaction. On the other hand, a general self-selection of the participants into the sports group, the treatment group, and the gym panel was necessary in order to increase the effect size: resource gains would have likely been lower if participants had not voluntarily chosen to participate in physical activity. Since participants decided to start participating in sports voluntarily, however, it is more probable that they enjoy the activity and embrace its benefits. This is in line with the notion that resources are most meaningful when they are related to the individual's idiographic personal goals (Diener & Fujita, 1995).

Additional limitations relate to the fact that there may be measurement biases when applying the COR-E to longitudinal research designs—as discussed earlier—and that in the treatment group of the SOEP study it is not known when (relative to the measurement time) the subjects started to regularly participate in physical activity. Regarding the latter issue, the treatment group potentially comprises both subjects who changed from being physically inactive to being physically active shortly after being interviewed for wave L and subjects who started being physically active shortly before being interviewed for wave M; there was no possibility to control for this variability.

Directions for future research

Based on the contributions and limitations of the analyses presented in this thesis, future empirical research on gain spirals should consider the following directions. First, to tackle the limitations discussed above, future studies should (a) pursue longitudinal designs in larger samples to allow for more rigorous statistical analyses, (b) investigate and control additional variables such as personality traits to reduce a potential self-selection bias, and (c) further test the COR-E measurement in longitudinal research settings. With regards to the SOEP it would be desirable to make the sports question a regular item that is included in all future waves. This would make it possible to select a larger sample of subjects who fulfill the condition of changing from being physically inactive in several consecutive years to being physically active in subsequent consecutive years. In addition, this data could be combined with the Big Five personality measures—which have been included in the SOEP for the first time in 2005 (Dehne & Schupp, 2007; Gerlitz & Schupp, 2005) and measured a second time in 2009—to create transparency on a potential self-selection effect driven by personality.

Next, future research should continue to test the curve progression of resources longitudinally. However, instead of hypothesizing an exponential progression, future research should test the theory of an asymptotic resource progression that was developed based on the results of the analyses in this thesis.

In addition, future gain spiral research should investigate potential spillover effects among life domains, especially between leisure and work. Theoretical and empirical studies suggest the possibility that interventions in the leisure domain may show a positive impact on the work domain, as well. Chapter 8 provides a review of the current thinking on spillover and an argument for including spillover effects in future gain spiral research.

Finally, it might be interesting to investigate how different types of physical activity—e.g., endurance training versus strength training, or team sport versus individual sport—affect different clusters of resources. It would also be of interest to better understand the influence of individual motives for participating in physical activity on resources. Thus it could be hypothesized, for example, that individuals who participate in physical activity for stress management versus weight management or social recognition motives experience resource gains on distinct clusters of resources. Understanding the influence of both the type of physical activity and the individual motives on resource gains would be valuable knowledge for designing effective resource interventions based on physical activity.

8   An argument for including spillover effects in future gain spiral research

As discussed in the preceding chapter, the empirical results consistently showed that leisure-time physical activity has positive effects on resources and subjective well-being. A natural follow-up question is whether gains in the leisure domain also spill over to the work domain and have positive effects on work resources, e.g., on work engagement. If this is the case, efforts to prevent burnout, enhance job satisfaction, or increase work engagement, for example, could be directly implemented in the leisure domain—either instead of or in addition to interventions taking place in the work domain. In this regard, Furnham (1991) suggests: "If a person is able to compensate for job dissatisfaction and the possible poor subjective well-being that is concurrent upon it, they may have much greater overall well-being than someone who is unable to compensate in their leisure or free time. Research suggests that this may be true and that subjective well-being may be dependent on both work and leisure satisfaction" (p. 256). The prominent theories and findings on work-leisure and leisure-work spillover will be reviewed in chapter 8.1.

The existence of a possible positive spillover mechanism from leisure to work is particularly interesting because the leisure domain is subject to less external regulatory factors than the work domain; thus, leisure conditions are much easier to change than work conditions. In addition, there is a line of thinking that suggests that many people do not yet realize the full potential of their leisure time. This is termed the "psychological inertia principle of leisure behavior" (Mannell, Zuzanek, & Larson, 1988, p. 302) and will be elaborated on in chapter 8.2. As a consequence of this principle, resource interventions in the leisure domain may prove to be highly effective. Finally, chapter 8.3 will derive hypotheses for future research designated to investigate the spillover effects of gain spirals.

8.1   Work-leisure and leisure-work spillover

Early thoughts on the interactional relationship between work and leisure are commonly traced back to Wilensky (1960), who distinguishes two alternative hypotheses regarding the nature of the work/leisure relationship: (1) the compensatory leisure hypothesis and (2) the spillover leisure hypothesis. The former suggests that work is compensated for during leisure by retreating into a deliberately different behavior, while the latter implies that the work habitus is extended to leisure. Or as Wilensky (1960) exemplifies:

> "The compensatory leisure hypothesis: […] the Detroit auto-worker, for eight hours gripped bodily to the main line, doing repetitive, low-skilled, machine-paced work which is wholly ungratifying, comes rushing out of the plant gate, helling down the superhighway at 80 miles an hour in a second-hand Cadillac Eldorado, stops off for a beer and starts a bar-room brawl, goes home and beats his wife, and in his spare time throws a rock at a Negro moving into the neighbourhood. In short, his routine of leisure is an explosive compensation for the deadening rhythms of factory life. […] The 'spillover' leisure hypothesis: Another auto-worker goes quietly home, collapses on the couch, eats and drinks alone, belongs to nothing, reads nothing, knows nothing, votes for no one, hangs around the home and the street, watches the 'late-late' show, lets the TV programmes shade into one another, too tired to lift himself off the couch for the act of selection, too bored to switch the dials. In short, he develops a spillover leisure routine in which alienation from work becomes alienation from life; the mental stultification produced by his labour permeates his leisure." (p. 544)

Notably, Wilensky (1960) describes what he sees as a unidirectional relationship between work and leisure, neglecting the effect of leisure on work. Second, Wilensky assumes work to be primarily dull and with a negative connotation; hence, spillover can only be negative, and compensation can always only be for undesired experiences. Partially in reaction to this view, Kabanoff and O'Brien (1980) develop and empirically substantiate a model that (1) includes the possibility of a bidirectional relationship between work and leisure and (2) considers a broader range of work qualities including positively demanding work. By incor-

porating these two aspects, their model implies four different work/leisure patterns, which result from the permutation of either active or passive work combined with either active or passive leisure. The resulting model is depicted in Figure 8-1. The original spillover and compensation hypotheses proposed by Wilensky (1960) are best represented in the first column and are labeled 'passive spillover' and 'supplemental compensation' respectively. The second column represents the possible patterns for people in active, i.e., positively challenging jobs: 'reactive compensation' when leisure is passive and 'active spillover' when leisure is active. Kabanoff and O'Brien's (1980) empirical study of the four patterns proposes that their prevalence depends on characteristics of the group or individual studied, such as gender, race, age, marital status, educational level, and income. Geurts and Demerouti (2003) provide a review of these prevalence-related factors.
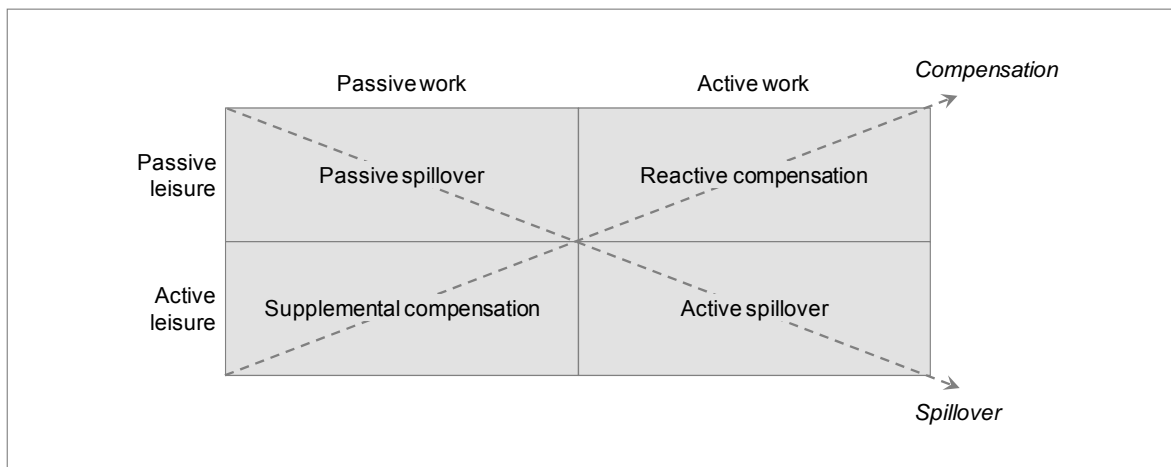
Figure 8-1 **Kabanoff's model of four work/leisure patterns as visualized by Geurts and Demerouti (2003) based on Kabanoff (1980)**

Two slightly different approaches to the relationship between work and leisure have been developed within the field of occupational health psychology, namely the role strain hypothesis and the role enhancement hypothesis; these are both based in role stress theory (Geurts & Demerouti, 2003). The role strain hypothesis has traditionally been the more prominent of the two opposing theories, and is

often linked to research on work-family conflict. It proposes that managing multiple roles (such as work and family) is stressfully demanding and hence creates strain (Geurts & Demerouti, 2003). The role enhancement theory, on the other hand, assumes a more positive view of the work-leisure relationship. It suggests that managing multiple roles may create effects of mutual facilitation or enhancement, since the participation in one role may create opportunities, skills, or other resources that can be drawn upon in other the other roles (Geurts & Demerouti, 2003). These two hypotheses can be interpreted in light of Kabanoff's four work/leisure patterns, as discussed above and depicted in Figure 8-1. In this light, the role strain hypothesis suggests that the different roles compete for their shares in the total amount of strain that can be tolerated, or in other words for the total amount of resources available. Hence, the roles need to be balanced against one another, so that when work is active, leisure should be passive (i.e., reactive compensation), and when leisure is active, work should be passive (i.e., supplemental compensation). Additionally, it allows for both domains, work and leisure, to be passive (i.e., passive spillover). Role enhancement, on the other hand, implies that active work may generate resources that can be used to facilitate an active leisure, or vice versa: active leisure may spawn resources that can be utilized for active work. Hence it can be related to the active spillover pattern.

There are other conceivable modes of interaction between work and leisure, which will be mentioned for the sake of completeness. In an attempt to be exhaustive (though not mutually exclusive), Furnham (1991) spells out six possible relationships between work and leisure (see Figure 8-2). In addition to the above-discussed possibilities of (1) a unidirectional relationship from work to leisure (based on compensation and/or spillover), (2) a unidirectional relationship from leisure to work, or (3) a bidirectional relationship between work and leisure, Furnham (1991) also includes the prospects of (4) no relationship, (5) a moderator

variable approach where, e.g., personality or sociocultural factors function as moderator between work and leisure, and (6) a path model resulting from a more complex moderator variable approach.
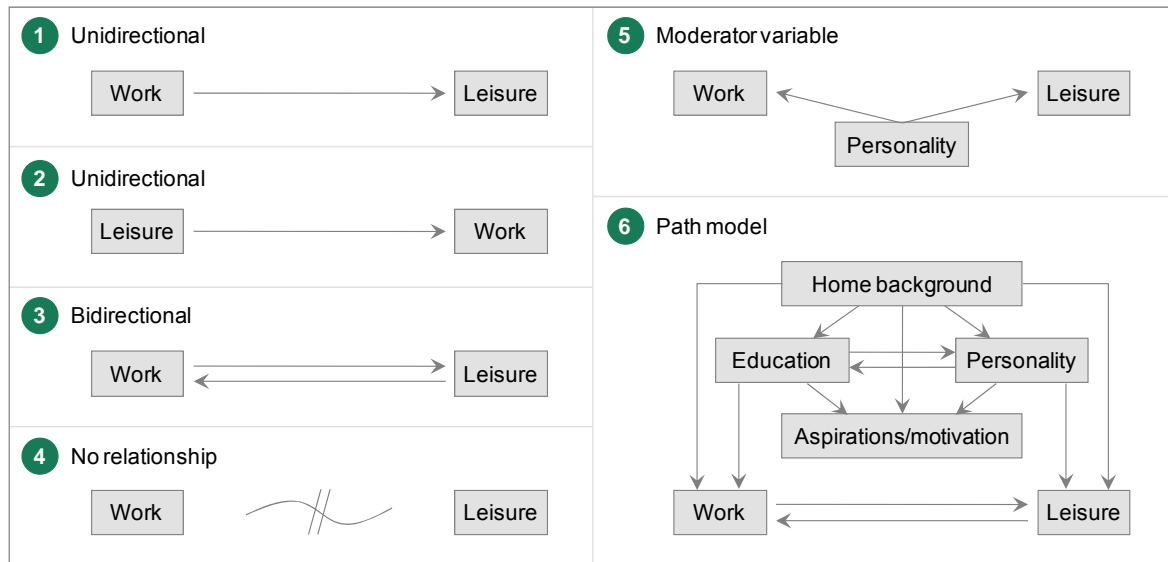
Figure 8-2   **Possible relationships between work and leisure (Furnham, 1991, p. 243)**

Theoretical and empirical evidence for the active spillover pattern

From a gain spiral perspective, the notion of a mutually enhancing relationship among various resources is best represented by the role enhancement hypothesis or the active spillover pattern. Hence this specific approach to the work-leisure interface will be elaborated further. The role enhancement hypothesis can be rooted in Marks' (1977) expansion approach to human energy, which he developed following the insight that the scarcity approach—which can be compared to the role strain hypothesis—cannot explain all findings of several empirical studies: "while considerable empirical evidence is offered that multiple-role players tend to run out of time and energy, there is also evidence of a minority of each sample who do *not* seem to be experiencing the effects of scarce personal resources" (p. 925). The expansion approach accounts for this gap, suggesting that "some roles

may be performed without any net energy loss at all; they may even create energy for use in that role or in other role performances" (Marks, 1977, p. 926). Contrasting the scarcity and the expansion approach, Marks (1977) exemplifies:

> "Goode [representing the scarcity approach] felt that when the family is pervaded by a sympathetic atmosphere, it uses up so little of the individual's energy that he has a lot left over for his more demanding roles […]. But given the expansion approach, the possibility arises that family activities may produce more energy, precisely because of the sympathy therein. It is not that the family's freedom from the strict ranking of performances drains us less, but that any supportive and sympathetic atmosphere gives us more." (p. 926)

A more general restatement of the concept of expansion respectively enhancement has been proposed by Greenhaus and Powell (2006), who define enrichment as "the extent to which experiences in one role improve the quality of life in the other role" (p. 73). By definition, this supports the existence of bidirectional relationships between work and nonwork, as active spillover may occur in both directions. Greenhaus and Powell (2006) offer example statements representing both directions: (1) "I think being a mother and having patience and watching someone else grow has made me a better manager. I am better able to be patient with other people and let them grow and develop in a way that is good for them" (p. 73; citing from Ruderman et al. (2002)); (2) "I have a 16-year old son and I use some of the things we do at work with him instead of yelling. We listen better here, we let people tell their side" (p. 73; citing from Crouter (1984)). While research has traditionally focused on the work domain as the source of spillover effects, the focus of this thesis is shifted towards leisure as the source of spillover effects. This is the case since the empirical studies of gain spirals included in this thesis (chapters 5 and 6) drew on leisure-time physical activity to operationalize resource gains. However, a reciprocal relationship is assumed, so that enhancements in work that have been caused by preceding positive leisure may in turn enhance succeeding leisure. This assumption again reflects the notion of gain spirals.

Several empirical studies support the notion of a positive relationship between nonwork and work domains. In particular, a number of studies report that affect experienced in nonwork is related to affect subsequently experienced at work. Rothbard (2001) finds bidirectional, enriching relationships between work and family; specifically, positive affect resulting from engagement in work increases engagement in the family role (for men), and positive affect resulting from engagement in the family roles increases engagement in work (especially for women). Based on the experience-sampling method, Judge and Ilies (2004) report that both job satisfaction and positive mood at work have a positive effect on positive affect and mood after work, and that the previous day's mood at home predicts the mood in the morning at work. Sonnentag, Binnewies, and Mojza (2008) focus on the relationship between evening recovery experiences, i.e., psychological detachment, mastery experiences, and relaxation, and morning affect in an employed sample, finding that evening mastery experiences significantly predict positive activation in the morning; likewise, evening relaxation significantly predict serenity in the morning. Sonnentag (2003) reports a positive effect of recovery on subsequent work engagement. As a logical consequence, Sonnentag (2005) advocates to add an off-work and day-level perspective to burnout research. Further studies provide evidence that positive experiences and active involvement in nonwork domains—such as recreation, family and community—generate personal resources that can be employed for work and result in high organizational commitment and job satisfaction (A. Cohen & Kirchmeyer, 1995; Kirchmeyer, 1992). In a similar vein, Mojza, Sonnentag, and Bornemann (2011) report that volunteer work—as one specific leisure-time activity—has a positive impact on work outcomes during the following day. In research specific to leisure-time physical activities, studies have shown positive effects on individuals' situational well-being before going to sleep at night (Sonnentag, 2001) and on several aspects of work performance (Pronk et al., 2004).

The notion of mutual enhancement and positive spillover may alternatively be explained based on the learning-generalization model, affect-congruency theory, the work-recreation cycle, or, importantly, COR theory. First, in their learning-generalization model, Kohn and Schooler (1982) suggest positive reciprocal effects between job resources and personal resources; these effects include a process of "learning from the job and generalizing the lessons to off-the-job realities" (p. 1272). Second, the positive spillover of *affect* may be explained based on the theory of affect-congruent judgment, which suggests that positive moods foster positive interpretations of events, and hence more positive thoughts and feelings (e.g., Forgas, 1994). Third, Wieland-Eckelmann and Baggen (1994) propose the work-recreation cycle as a theoretical model to analyze spillover effects. In the model, spillover between the work process and the recreation process (and vice versa) is represented via the two states: (1) the consequences of the demand situation, which is the result of the work process and simultaneously forms the basis for the recreation process, and (2) the psychophysical status, which is the result of the re-covery process and which at the same time provides the basis for the work pro-cess. The cycle is then affected by four moderators: changeover from recreation to work is moderated via (1) the relation of recreation possibilities to recreation need and (2) the balance of available resources to the resources required for work; changeover from work to recreation is impacted by (3) the subjective relation of work output to the effort invested and (4) the relation of the ability to recover to the consequences of the demand process (Wieland-Eckelmann & Baggen, 1994). For the work-recreation cycle to account for a scenario of positive spillovers, these four moderating relations need to be greater or equal to 1—i.e., the numerators (e.g., recreation possibilities) need to exceed the denominators (e.g., recreation need). Figure 8-3 provides a graphic representation of the work-leisure cycle and the discussed constructs.
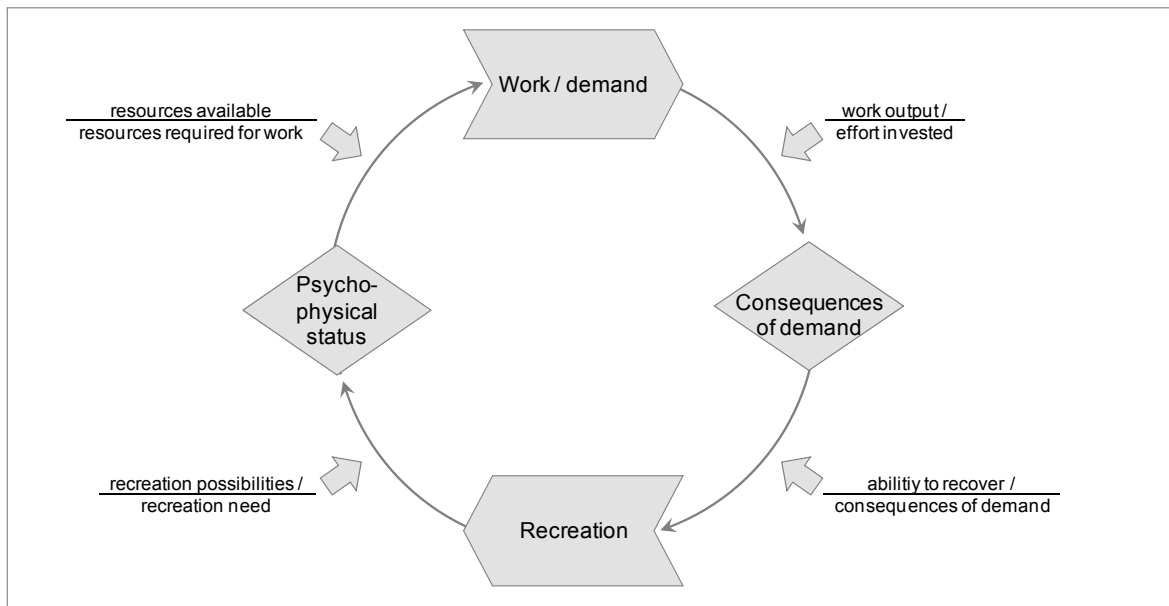
Figure 8-3   The work-recreation cycle as proposed by Wieland-Eckelmann and Baggen (1994)

Finally, work-leisure and leisure-work spillover can also be interpreted from a COR theory perspective. In this context, as well, studies and thinking related to negative spillover between domains related to strain (e.g., Grandey & Cropanzano, 1999) are overrepresented. However, Geurts and Demerouti (2003) highlight COR theory as a theory that allows to go beyond the traditional scarcity approach and embrace the possibility of an expansion approach: "A difference with the more traditional role stress theories is that the fulfillment of multiple roles is not inevitably related to the experience of higher levels of stress; each role (e.g. being married or being parent) might also offer resources that help individuals to deal with other demands associated with the fulfillment of other roles (e.g. being employed)" (p. 286). Furthermore, Wayne et al. (2007) propose a theoretical explanation of work-family facilitation—termed "resource-gain-development perspective"—which draws on (a) COR theory, (b) ecological systems theory, and (c) positive organizational scholarship. This being said, no *empirical* studies of positive spillover effects could be found which explicitly draw on COR theory. How-

ever, some studies in the field of work-family and family-work enrichment explore the facilitating influence of selected resources such as marital status, religiosity, family support, flexible work policies, or supervisor support (Balmforth & Gardner, 2006; Hassan, Dollard, & Winefield, 2009; Hill, 2005; Wayne, Randel, & Stevens, 2006). Hassan et al. (2009) theorize on the positive spillover effects between work and family according to COR theory: "as a person gets older, he /she is more likely to have a senior position in the organization, which in turn, may create more resources such as money and other benefits.; in addition, having teenage children may enhance a person's negotiation skills, which may be beneficial at work" (p. 58). In a similar vein, Geurts and Demerouti (2003) argue that "the existence of home resources (e.g. a domestic help, domestic appliances, a babysitter, spouse support) that enable individuals to deal with the demanding aspects in their home situation, […] will be associated with positive load effects that will facilitate one's functioning at work" (p. 289).

A resource-based conceptualization of work-family enrichment is also adapted by Greenhaus and Powell (2006), who suggest five relevant categories of resources: skills and perspectives, psychological and physical resources, social-capital resources, flexibility, and material resources. Based on the generation of these resources in one role, they propose two paths by which the resources may be transferred to another role (see Figure 8-4). The instrumental path describes a direct transfer of resources generated in one role to another role; the most intuitive example is that "money derived from employment can be used to enhance the quality of family life through the purchase of goods and services that make family life easier or more enjoyable" (Greenhaus & Powell, 2006, p. 82). The affective path refers to a more indirect transfer in which resources generated in one role promote positive affect in that same role, which in turn results in increased performance in the other role and hence positive affect in the other role. The reasoning for the af-

fective path is two-fold: first, successfully generating resources in a role can be interpreted as performing well in that role, which is generally reflected in positive affect; second, positive affect in that role increases engagement in another role, since positive affect is considered (1) to be associated with benevolence and helping behavior, (2) to be related to an outward focus of attention, and (3) to expand one's level of energy (Greenhaus & Powell, 2006).
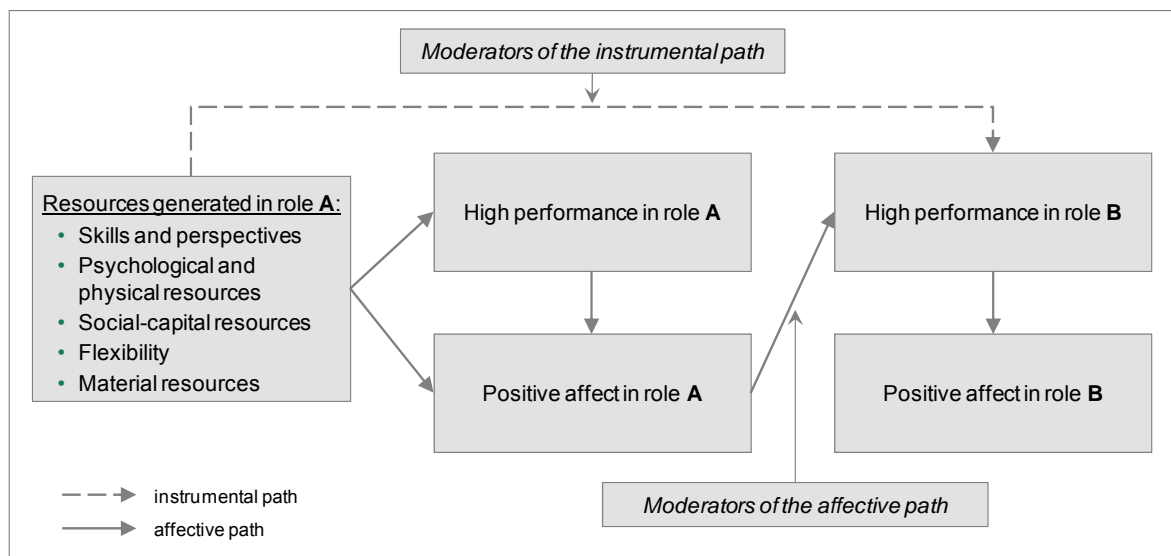
Figure 8-4   A resource-based model of role enrichment (Greenhaus & Powell, 2006)

To summarize, research and thinking on the interfaces between work and nonwork have historically focused on (a) negative and compensatory effects, (b) the directed relationship from work to nonwork, and (c) the family as one particular subdomain of the nonwork domain. In the context of this thesis, the antipodal focus is most relevant, which is also in line with the more recent research on the subject. Hence, the focus here is on (a) positive spillover and mutual enhancement effects, (b) the bidirectional and reciprocal relationships between nonwork and work, with an emphasis on the nonwork-to-work direction, and (c) leisure time as the specific subdomain of the nonwork domain. In view of this focus, both theoretical and empirical evidence of positive spillover effects between leisure and

work as well as between work and leisure have been discussed. The finding that the two domains mutually enhance one another is clearly consistent with the notion of gain spirals and provides an additional avenue for examining and explaining their functioning. Hence, positive spillover effects have also been grounded in COR theory and interpreted from a resource perspective.

A final comment needs to be made: although the focus here has been on the positive and mutually enhancing work/nonwork interactions, it is clearly not possible to deny the existence of negative and compensatory effects; e.g., there is indisputably a negative relationship between time spent on work and time spent on leisure. However, work and leisure can be thought of as multidimensional concepts. As a consequence, there may not be a single prevailing work/leisure pattern, even for a single individual; rather, different patterns may be at work at the same time, but on different dimensions (cf. Furnham, 1991; Kabanoff & O'Brien, 1980). Thus, while the limited number of hours in a day makes a compensatory work/leisure pattern with respect to the time dimension unavoidable, there may simultaneously be a pattern of positive spillover in view of, e.g., an affect dimension. This thinking is in line with Greenhaus and Powell (2006), who comment that "role accumulation can provide more extensive resources to be applied to other roles that promote enrichment, as well as time constraints and stressors that produce conflict" (p. 87). Notably, though, researchers have not agreed on the specific dimensions of work respectively leisure (Furnham, 1991). For example, Kabanoff and O'Brien (1980) describe work and leisure using the five attributes influence, variety, pressure, skill utilization, and interaction, while Edwards and Rothbard (2000) distinguish the four dimensions mood, values, skills, and behavior. In line with the resource perspective that is the explicit focus throughout this thesis, it is suggested here to define the dimensions of work and leisure according to the resources specified by COR theory (cf. chapter 2.1.3). Through this lens, dimensions of work and

leisure can be considered to be resources, e.g., feeling successful, time for adequate sleep, feeling valuable to others, hope, or stamina/endurance. These individual resource-based dimensions may then follow any of the relationships that have been discussed within this chapter.

Future COR theory research could use these insights to shed light on possible spillover effects in the context of resource gain spirals. In the following chapter it will be elaborated why the leisure domain may be an effective lever for interventions aimed at increasing resources and subjective well-being.

8.2   The psychological inertia principle of leisure behavior

Although the importance of leisure—particularly with regards to productivity during work—was already recognized by Graf (1922), it has historically been ignored by organizational psychology. Also, leisure has most commonly been defined in discrimination from work. For example, Brightbill (1960) defines leisure as the discretionary time that remains when time required for existence and time required for subsistence are excluded. Similarly, Kelly (1972) defines it as 'nonwork', i.e. "leisure is not remunerative, not required by social expectations, and not necessary for status or survival" (p. 50). However, Kelly (1972) also acknowledges that not all nonwork is automatically considered leisure, or, as Pieper (1952) puts it, "leisure […] is not the inevitable result of spare time" (p. 43). As a reaction to these definitions, more positive definitions of leisure have been developed, describing what it is rather than what it is not. According to these more positive definitions, one important quality of leisure time is that it is free, in the sense that people can freely chose which activities they want to pursue (e.g., Dumazedier, 1960; Roberts, 1978).

Some authors also specify the range of functions that leisure time activities need to fulfill. Meyersohn (1972) lists four functions: (1) rest or respite, (2) entertainment, (3) self-realization, and (4) spiritual renewal (as cited by Zuzanek, 2006). Similarly, Dumazedier (1974) describes that "leisure is activity […] to which the individual turns at will, for either relaxation, diversion, or broadening his knowledge" (p. 133). Kaplan (1975) identifies activities that provide "opportunities for recreation, personal growth and service to others" (p. 26). A more recent perspective on the functions of leisure time is provided by Sonnentag and colleagues, who define what they call "recovery experiences" via (1) psychological detachment from work, (2) mastery experiences, (3) relaxation, and (4) need satisfaction (Mojza et al., 2011; Sonnentag et al., 2008).

For non-work time to qualify as leisure time, Kaplan (1975) also states that it must be seen as leisure by the individual, and must be "psychologically pleasant in anticipation and recollection" (p. 26). Additionally, some authors emphasize that leisure time needs to be related to intrinsically rewarding experiences, i.e., activities that are an end in themselves (Iso-Ahola, 1980; Neulinger, 1974). Overall, what Kelly (1972) pointed out may still be true: "theorists have not agreed about how much nonwork should be defined as leisure" (p. 50).

The circumplex model of affect (Watson, Clark, & Tellegen, 1988; Watson, Wiese, Vaidya, & Tellegen, 1999) distinguishes the two orthogonal constructs positive affect and negative affect. This model also suggests that in order to feel content, happy, and satisfied, it is *not* sufficient to experience a lack of negative affect; rather, it is essential to simultaneously experience positive affect. A state of unhappiness, on the other hand, is the result of low positive affect and high negative affect. In applying this perspective to the work situation, Wieland, Krajewski, and Memmou (2004) propose a four-field schema for classifying work conditions according to their demand optimality (see Figure 8-5). The scope of 'demand' is,

however, somewhat broader than purely affect-based and includes emotional, mental, and motivational demand as well as physiological demand. The top-left field, the optimal demand situation, is characterized by high positive demand and no or low levels of negative demand; this represents the target state.
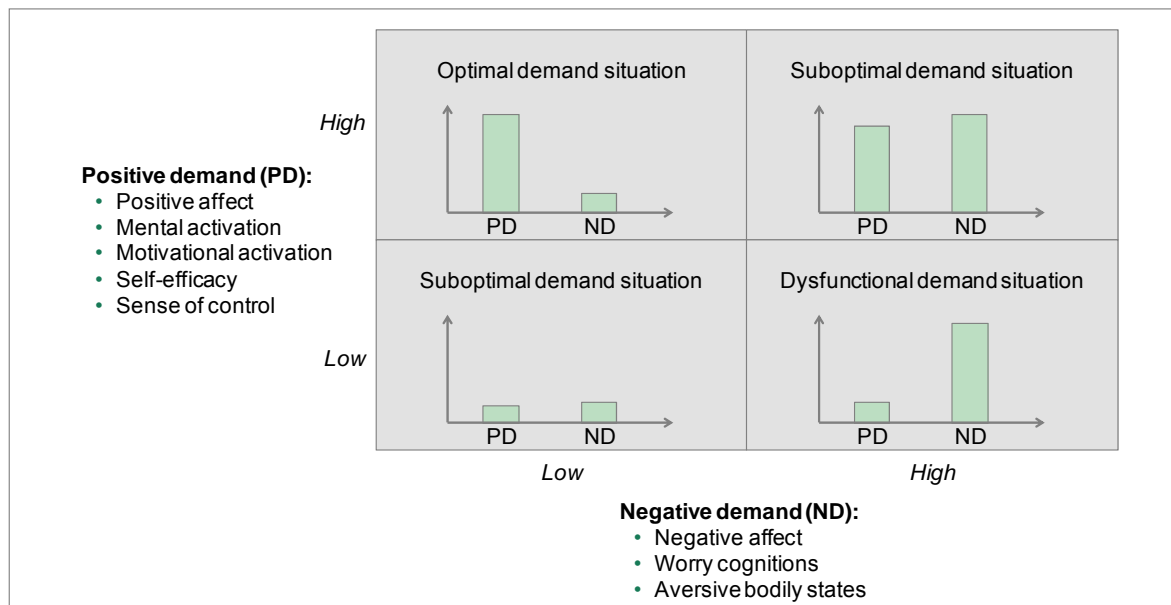
Figure 8-5   Four-field schema of demand optimality based on Wieland et al. (2004)

Transferring this model to the leisure domain, it would be expected that since they can *freely choose* their leisure activities, people pursue leisure activities that represent an optimal demand situation: low levels of negative demand and high levels of positive demand. However, several empirical studies fail to support this thinking. One prominent finding from flow theory termed the 'work paradox' reports that people tend to have more flow experience in work than in leisure: while work meets the conditions of flow 47% to 64% of the time for blue-collar workers and managers, respectively, leisure activities provide flow less than 20% of the time (Csikszentmihalyi & LeFevre, 1989). Flow is defined as "the holistic sensation present when we act with total involvement" (Csikszentmihalyi, 1975, p. 43), which arises in situations which—at equally high levels—provide challenges and require skills. A 'work paradox' arises, since although people experience more flow and

hence positive feelings at work than at leisure, during work they state that they would rather be doing something else, but not so during leisure. Csikszentmihalyi and LeFevre (1989) explain this paradox against the background of culture and socialization: "apparently, the obligatory nature of work masks the positive experience it engenders; in deciding whether they wish to work or not, people judge their desires by social conventions rather than by the reality of their feelings" (p. 821).

An alternative explanation has been offered by Schallberger and Pfister (2001), who replicated this paradox. Drawing on measures of positive and negative affect, they note that the experience of flow in work involves high levels of positive affect, but at the same time produces medium to high levels of negative affect. Leisure experience, on the other hand, appears to be—on average—low in both positive affect and negative affect (Schallberger & Pfister, 2001). Notably, *both* work and leisure describe *suboptimal* demand situations in terms of Wieland et al.'s (2004) four-field schema of demand optimality. While it could be argued that individuals are largely unable to change their work situations, this finding is surprising with respect to leisure, which by definition refers to freely chosen activities. Schallberger and Pfister (2001) conclude that people fail to invest in their leisure time in a way that would create positive affect: they tend to spend their leisure time engaging in passive and unchallenging activities with a primary focus on relaxation (such as, e.g., watching TV), rather than in more active and challenging activities (such as, e.g., rock-climbing). Beatty and Torbert (2003) provide a vivid illustration of this circumstance, suggesting that cultivating true leisure is very demanding:

> "We, as a culture, have virtually forgotten what it means to cultivate leisure. Leisure, defined here as voluntary, reflective, developmental inquiry, is missing. Our increasing focus on work may have atrophied our capacity to engage in leisure— our leisure skills. Because our skills are poor, critics complain that increases in free

time will only lead to more time watching television or shopping at the mall. Robinson and Godbey (1997) offer an interesting and shocking illustration of this: They estimate that the average American spends 40% of his or her free time watching television. Ironically, they also report that people do not enjoy watching TV compared to other leisure alternatives; they do it, however, because it's cheap and easy." (p. 247)

Along this line, Csikszentmihalyi and LeFevre (1989) conclude that "apparently a feeling of using one's skills in a challenging situation is difficult to achieve outside of work" (p. 820). They also find that the free time activity that generates most flow is driving. Among the blue collar sample, driving accounts for more than 25% of total flow time, and for only 8% of time not in flow. Watching TV, on the other hand—which was the largest single component of leisure time—accounted for only 8.5% of total flow time, but for 25% of the time not in flow.

A related insight is that people shy away from investing the initial effort which is required for experiencing positive affect, and that they need some sort of external motivation in order to overcome their resistance. Mannell, Zuzanek, and Larson (1988) call this phenomenon the "psychological inertia principle of leisure behavior" (p. 302). Looking at leisure experiences, Mannell et al. (1988) find that the activities that create the highest levels of flow are those that are freely chosen but externally motivated—e.g., playing with one's children out of a sense of obligation or exercising for health reasons. They argue that these externally motivated activities demand higher levels of initial effort, commitment, and obligation than the freely chosen and intrinsically motivated activities such as reading or watching TV, but as a consequence of the invested effort they also produce more intrinsically satisfying flow (1988, p. 289).

Overall, there seems to be a lack of positive affect, and more generally positive demand of, related to leisure time activity. Thus, encouraging leisure time activities that exhibit higher levels of positive demand—such as engaging in physical

activity, for example—seems to be a beneficial objective. This is even more clearly the case if spillover research confirms positive spillover effects of increased leisure time resources and well-being into the work domain.

8.3   Hypotheses for future research

Based on the preceding discussion of theoretical and empirical findings regarding (a) the spillover between leisure and work and (b) the psychological inertia principle of leisure behavior, the following hypotheses are suggested a foci for future gain spiral research (cf. Figure 8-6):

Hypothesis 1: The resource gains resulting from a resource intervention in the leisure domain—e.g., starting to participate in leisure-time physical activity— have a positive effect on subjective well-being in leisure.

Hypothesis 2: The subjective well-being in leisure in $T(x)$ has a positive, cross-lagged effect on the subjective well-being at work in $T(x+1)$.

Hypothesis 3: The subjective well-being at work in $T(x)$ has a positive, cross-lagged effect on the subjective well-being in leisure in $T(x+1)$.
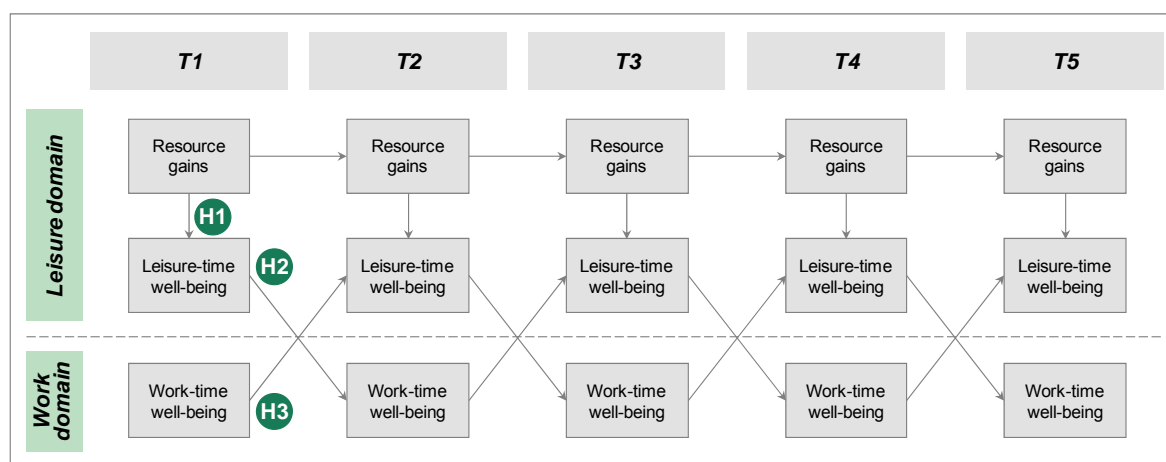
Figure 8-6   A proposed model for future research on spillover effects of gain spirals

9   Summary and conclusion

In a very recent call for papers by the Journal of Occupational and Organizational Psychology, four major innovative trends related to psychological resource theories were identified: "(1) an emphasis on positive psychological processes, (2) a movement towards dynamic process models and developments over time, (3) a movement towards active psychology, emphasizing purposeful behaviour instead of passive coping responses, and (4) the use of multi-level perspectives focusing on either different life domains, different levels of organizations, or dyads in a social interaction" (Gorgievski, Halbesleben, & Bakker, 2011, p. 4). All four trends have been addressed within this thesis: the focus on *gain* spirals and growth of resources emphasizes positive psychological processes; the investigation of curve *progressions* over time reflects the notion of dynamic processes and developments in the course of time; the proactive resource *intervention* of participating in physical activity implies active rather than passive coping responses; and finally the discussion of possible *spillover* effects between leisure and work domains provides the proposed multi-level perspective. Thus, overall, this thesis quite accurately reflects the *zeitgeist* of current thinking on psychological resource theories.

The objective of this thesis was to expand the boundaries of the theoretical and empirical foundations of resource gain spirals as defined by COR theory. To achieve this purpose, the four main goals of this thesis were to (1) review the existing empirical research on gain spirals as defined by COR theory in order to identify (a) known and empirically substantiated insights and (b) current research gaps and limitations; (2) develop a research agenda that can guide future research to efficiently close existing research gaps; (3) conduct initial empirical research based on the guidelines developed in the research agenda; (4) extend the thinking of gain spirals into the domain of leisure-work spillover effects. In pursuing these goals,

the thesis contributes to the existing gain spiral research in a number of ways, on both theoretical and empirical levels.

Theoretical contribution

In this thesis a literature review on gain spiral research was conducted for the first time—to best knowledge—in the over twenty years of COR theory history. Especially in relatively new fields such as gain spiral research, literature reviews are highly valuable in that they (a) create transparency regarding what is already known and empirically established and (b) identify the major limitations of the existing research, including major research gaps. The primary finding of the literature review conducted in this thesis was that the existing eleven empirical studies consistently reported evidence for reciprocal relationships between resources, but altogether failed to show level-wise increases in resources over time.

Based on this major limitation of the existing gain spiral research and the additionally identified research gaps, a research agenda was outlined for the first time. The research agenda is a valuable contribution to the field, as it can efficiently guide future gain spiral research, including the research conducted in this thesis. Two tiers have been included in the research agenda: the first tier includes research directions that are required to fully substantiate gain spirals, while the second tier comprises research questions that need to be answered in order to clarify details on the effectiveness of gain spirals. Notably, the second tier is not assumed to be exhaustive and thus may be enriched with additional relevant research questions in the future. Overall, the two-tiered research agenda provides a useful framework for distinguishing between first priority, mandatory future research and second priority, facultative future research.

This thesis is also unique in critically discussing the assumption of an exponential resource curve progression in COR theory. In a systematic approach, four potential curve shapes of resource gain spirals—including an exponential shape as well as linear, asymptotic, and polynomic progressions—were reviewed. Drawing on theories both from psychology and other disciplines, it was argued that an exponential curve progression is unlikely, at least for some resources. In this context, the argument has been made for the first time that a differential approach might be required to establish curve progressions for each resource separately; conceivably, the resource "money" has the potential to grow relatively limitless, while the resource "personal health" can only grow up to the ceiling represented by perfect health. Ultimately, based on the empirical findings, an alternative model of asymptotical resource growth was proposed.

Another theoretical contribution of this thesis is a theory regarding possible resource spillover effects. It was argued that resource gain spiral research should draw on the existing spillover research, e.g., stemming from the domains of role theory or the work-family interface, to investigate the existence of a possible resource spillover from the leisure domain to the work domain. Specifically, it was hypothesized that resource gains resulting from a resource intervention in the leisure domain may spill over to the work domain. Future testing of this hypothesis was identified as important for two reasons. First, there seems to be a gap in the positive affect or positive demand generated by individuals' leisure time activity— a circumstance that was termed the 'psychological inertia principle of leisure behavior'. Second, altering circumstances to increase the experience of positive affect and positive demand is easier for leisure time than it is for work time, which is generally externally regulated. In keeping with the reciprocal nature of gain spirals, it was further hypothesized that resource gains in the work domain also reciprocally spill over back to the leisure domain.

In aiming to find a powerful resource intervention that would trigger level-wise increases in resources over time, this thesis is also unique—to best knowledge—in offering a hypothesis regarding the positive effects of physical activity on specific COR resources. For this purpose, objective scientific evidence for the effects of physical activity on psychological and physiological well-being has been combined with subjective motives for participating in physical activity. Out of the 74 COR resources, 22 were hypothesized as being particularly prone to be impacted by physical activity; later, the empirical results largely confirmed this selection. Thus, within this thesis, the rather general COR theory has been theoretically applied and specified to a novel domain.

Furthermore, this thesis has contributed to the theoretical understanding of the relationship between resources and subjective well-being. Based on the existing literature, four key dimensions were identified on which resources and well-being can be contrasted. Developing this theory further, four levers were suggested that bridge the conceptual differences between resources and subjective well-being: (1) considering resources on an aggregated level, (2) allowing for resources to differ in their impact strength and thus to form a resource hierarchy, (3) including the idiographic goal-relevance of each resource, and (4) allowing for interaction effects among resources. Finally, a novel theoretical model for reconciling resources and subjective well-being has been developed and elaborated.

Empirical contribution

First, all three key hypotheses were tested in two distinct samples and using two distinct operationalizations of resources as dependent variables. Notably, the tests revealed consistent findings in both samples, which compensates to a certain degree for the small sample sizes. Another strength of the empirical contribution in this thesis is that one of the two studies—the SOEP study—draws on data from

the professionally conducted longitudinal panel study, which has been in place since 1984 and which has since been used in numerous research projects and continuously improved.

Second, the two empirical studies conducted within this thesis are unique in that they are quasi-experimental *intervention* studies. Prior to this thesis, no empirical research on resource gain spirals had considered a resource intervention. Thus, these studies are also the first studies to confirm level-wise increases of resources over time. This is an important contribution in that gain spirals can only be considered empirically confirmed when both conditions—the reciprocal relationship among resources *and* a level-wise increase of resources over time—are fulfilled. In this context, the two conducted studies are also the first—to best knowledge—to empirically investigate the positive effect of *physical activity* on resources as defined by COR theory.

Third, the two studies are the first gain spiral studies to implement control group designs. As a result, the positive effects of physical activity as a resource intervention could be confirmed not only within-subjects, but also between-groups, thus making it possible to rule out measurement artifacts such as a learning effect.

Fourth, the gym study is unique in that it is the first gain spiral study to implement the original COR evaluation scale. It thus overcomes a limitation that has been present in the previous empirical studies, namely considering only very few key resources instead of pursuing the integrated resource approach postulated by COR theory. Aside from more closely adhering to theory than prior studies, two additional empirical contributions arise from drawing on the COR-E to measure resources: (1) the hypothesis regarding which of the COR-E resources would be more directly impacted by physical activity could be tested—and largely confirmed; (2) the data from the gym sample combined with the data from the pretest

sample indicate that there may be measurement issues when using the COR-E in longitudinal designs—an indication that is crucial to either refute or remediate, if the COR-E is to be implemented in further longitudinal studies (which would be desirable).

Fifth and finally, the studies in this thesis are the first studies to empirically investigate the curve progression of resource gain spirals. COR theory's hypothesis of an exponential resource growth was tested and rejected in both samples. Instead, the data suggested that—following an initial resource intervention—resources grow at a decreasing rate, rather than at an increasing rate, which would represent self-sustaining resource growth. Based on this finding it has been proposed to hypothesize and test an asymptotical resource growth model that shows initial resource gains that flatten out over time.

Practical implications from an organizational psychology perspective

Overall, the novel empirical findings reported in this thesis substantiate the existence of resource gain spirals; however, these appear to progress differently over time than originally proposed by COR theory. Still, the positive effect of a resource intervention such as participating in physical activity on an individual's resource levels has been confirmed. This suggests that preventive actions in the tradition of salutogenic thinking are indeed an effective means to build individuals' resources, which in turn puts these individuals in a better position to protect themselves against, prevent, or cope with future resource losses. As the number of burnout cases continues to rise, proactively strengthening employees' resources is more important than ever. Thus, resource interventions are crucial both on a micro- and macroeconomic level.

On a *microeconomic* level this implies that if organizations want to win the war for talent, they have to systematically invest in building their employees' resources. Especially in people-centric businesses, the employees' resources directly translate into the organization's resources; therefore, increasing the employees' resources increases the organization's resources. The employer, therefore, should promote physical activity as a powerful and broad-based resource intervention, either during the work day or after work. *During* the work day, employees should be offered opportunities for activity and encouraged to take active breaks. In fact, the positive effects of short breaks have been scientifically acknowledged for a long time (Graf, 1922). Good examples of organizations leading the way in this regard are a number of universities (e.g. the University of Wuppertal) that started offering instructed active breaks for their students (5-minute breaks during classes and longer breaks between classes) and for their employees (15-minute breaks which are conveniently instructed in their offices). The research presented in this thesis supports that more employers should invest in similar active break programs. Notably, this does not contradict the findings that more relaxation-oriented break programs have also proven to be very efficient (Krajewski, 2006; Krajewski & Wieland, 2003).

After work, employees should be offered opportunities and encouraged to participate in more extensive physical activity. More organizations should offer both opportunities for *individual exercise*, such as an on-campus corporate gym or subsidized gym memberships for nearby fitness centers, and opportunities for *team sports* such corporate running groups, soccer teams, bike teams, etc. Companies already investing in well-being programs for their employees have found these investments to pay off, especially in terms of reduced absenteeism and presenteeism (e.g., Greenberg, 2011, p. 197).

However, in addition to merely investing money in programs and simply *offering* opportunities, employers need to build a *culture* of physical activity. Most prominently, this includes actively encouraging employees to be physically active, e.g., by providing employees with the time flexibility required for taking advantage of the offers, by promoting the notion that an evening in the gym may be more important and more efficient than another long night in the office, by having management lead by example, or by organizing corporate tournaments that fuel employees' sport ambitions and foster maintenance of healthy habits. Similarly, the need for a culture of health is propagated in the context of corporate health management: programs can only be effective if they equally target (1) organizational conditions and structure, (2) human behavior, and (3) organizational culture and leadership philosophy (BARMER/GEK, 2010, pp. 44 ff.).

When including a spillover perspective—such that leisure resource spillover to the work domain—even more opportunities to increase work resource arise. If employees start being more physically active in the leisure time, this could result in an increase in valuable work resources. Obviously, this applies to other resource-building leisure time activities, and not just physical activity. Most notable in this context is the research conducted by Sabine Sonnentag and colleagues, who report the positive effects of various leisure-time experiences—including physical activity (Sonnentag & Natter, 2004), as well as social activity (Fritz & Sonnentag, 2005), volunteer work (Mojza et al., 2011), and mastery experiences in general (Sonnentag et al., 2008)—on a range of outcome variables relevant for the work domain, including general well-being and different aspects of job performance.

While it is primarily the responsibility of the individual employees to organize their leisure time in such a way that it provides the most valuable recovery experiences, it is in the employers' responsibility to provide the employee with the required off-work time and flexibility. In a paper titled "How to use reduced hours

to win the war for talent", Barnett and Hall (2001) elaborate why and how employers have to enable their employees to pursue their personal needs, such as more time for families, other relationships, and themselves—e.g., for personal development, personal interests, volunteering, exercise, reading, etc. However, the authors also stress the importance of (a) a fit between the number, distribution, and flexibility of work hours and the individual employee's needs and (b) the right organizational parameters, e.g., guaranteeing reduced-hours employees access to compensation, assignments, and promotions.

Notably, some good examples already exist. Looking at management consulting, a particularly people-centric business, the Boston Consulting Group has started implementing a "predictable time-off" program to provide employees with predictable leisure-time regardless of the generally high workload. An empirical study accompanying this program confirmed that—counter-intuitively—employees' efficiency and effectiveness increased despite the reduced hours, as did job satisfaction, open communication in the project teams, the likelihood that employees' could imagine a long-term career at the firm, and ultimately the value delivery to the client (Perlow & Porter, 2009). A second example from the field of management consulting is McKinsey, who in 2011 publicly advertised their work flexibility program under the slogan "Wer persönlich wächst, wächst auch beruflich" ("those who grow personally grow occupationally, too"). The program allows employees up to three months of unpaid "personal time" per year to pursue individual personal interests as diverse as writing a book, doing social projects, sailing around the globe, or simply spending more time with their families.

Finally, on a *macroeconomic* level, public policy and state-run organizations such as health insurances, schools, and universities should exhaust their potential to promote active leisure-time and participation in physical activity in the general population. In Germany, pioneers in this regard are many statutory health insurances,

which offer health bonus programs that are designed to incentivize members to participate in health-promoting activities such as gym classes, stress reduction seminars, or nutrition courses. Overall, more of these programs and more awareness of these programs are needed.

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Appendix

A   SOEP study: documentation of the analyses

A.a   Building the SPSS mastersheet for analyzing the SOEP data

Since the SOEP data is organized in a hierarchical structure, a flat file had to be created as basis for the analyses. The flat file was created by matching the variables for sports behavior and life satisfaction included in the personal-level data sheets of each wave I through P to the person level master file. For a technical description of the matching process refer to Haisken-DeNew and Frick (2005). The specific variables taken from the person-level data sheets are listed below.

Year	Wave	Variable containing sports behavior	Variable containing life satisfaction
1992	I	IP0703	IP10901
1993	J	/	JP10901
1994	K	KP1203	KP10401
1995	L	LP0613	LP10401
1996	M	MP0503	MP11001
1997	N	NP0303	NP11701
1998	O	OP0613	OP12301
1999	P	PP0303	PP13501

A.b One-way ANOVA and planned comparisons for sport participation and life satisfaction

Descriptives

Average life satisfaction waves J-P

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
non-sports group	3991	-.2301	1.42466	.02255	-.2743	-.1859	-6.81	3.19
inconsistent group	4188	.0786	1.34986	.02086	.0377	.1195	-6.67	3.19
sports group	1016	.5135	1.14504	.03592	.4430	.5840	-5.38	3.19
Total	9195	-.0073	1.38212	.01441	-.0356	.0209	-6.81	3.19

Test of Homogeneity of Variances

Average life satisfaction waves J-P

Levene Statistic	df1	df2	Sig.
34.249	2	9192	.000

ANOVA

Average life satisfaction waves J-P

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	504.648	2	252.324	135.966	.000
Within Groups	17058.350	9192	1.856		
Total	17562.998	9194			

Robust Tests of Equality of Means

Average life satisfaction waves J-P

	Statistic[a]	df1	df2	Sig.
Welch	159.720	2	3067.240	.000

a. Asymptotically F distributed.

Contrast Coefficients

	grouping		
Contrast	non-sports group	inconsistent group	sports group
1	-1	0	1
2	0	-1	1
3	-1	1	0

Contrast Tests

		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Average life satisfaction waves J-P	Assume equal variances	1	.7436	.04787	15.534	9192	.000
		2	.4348	.04764	9.128	9192	.000
		3	.3088	.03013	10.246	9192	.000
	Does not assume equal variances	1	.7436	.04241	17.532	1897.666	.000
		2	.4348	.04154	10.468	1766.126	.000
		3	.3088	.03072	10.051	8092.824	.000

A.c One-way ANOVA and planned comparisons for sport participation and life satisfaction (groups matched for age)

Descriptives

Average life satisfaction waves J-P

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
non-sports group	1016	-.1931	1.39204	.04367	-.2788	-.1075	-6.52	3.19
inconsistent group	1016	.0259	1.33149	.04177	-.0561	.1079	-5.38	2.90
sports group	1016	.5135	1.14504	.03592	.4430	.5840	-5.38	3.19
Total	3048	.1154	1.32668	.02403	.0683	.1625	-6.52	3.19

Test of Homogeneity of Variances

Average life satisfaction waves J-P

Levene Statistic	df1	df2	Sig.
19.275	2	3045	.000

ANOVA

Average life satisfaction waves J-P

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	265.871	2	132.935	79.416	.000
Within Groups	5097.090	3045	1.674		
Total	5362.961	3047			

Robust Tests of Equality of Means

Average life satisfaction waves J-P

	Statistic[a]	df1	df2	Sig.
Welch	86.194	2	2014.781	.000

a. Asymptotically F distributed.

Contrast Coefficients

Contrast	grouping		
	non-sports group	inconsistent group	sports group
1	-1	0	1
2	0	-1	1
3	-1	1	0

Contrast Tests

		Contrast	Value of Contrast	Std. Error	t	df	Sig. (2-tailed)
Average life satisfaction waves J-P	Assume equal variances	1	.7066	.05740	12.310	3045	.000
		2	.4876	.05740	8.494	3045	.000
		3	.2190	.05740	3.816	3045	.000
	Does not assume equal variances	1	.7066	.05655	12.496	1957.183	.000
		2	.4876	.05509	8.850	1985.488	.000
		3	.2190	.06043	3.625	2025.999	.000

A.d Mixed ANOVA for between-subjects factors (group) and within-subjects factor (time)

Within-Subjects Factors

Measure:MEASURE_1

time	Dependent Variable
1	AVG_LS_KL
2	AVG_LS_MNOP

Between-Subjects Factors

		Value Label	N
grouping	1	inconsistent group	55
	2	sports group	55
	3	Experimentalgruppe1	55

Descriptive Statistics

	grouping	Mean	Std. Deviation	N
AVG_LS_KL	inconsistent group	.0459	1.87394	55
	sports group	.6192	1.40783	55
	Experimentalgruppe1	.1283	1.77606	55
	Total	.2644	1.70644	165
AVG_LS_MNOP	inconsistent group	.0225	1.64755	55
	sports group	.5222	1.42560	55
	Experimentalgruppe1	.4722	1.33504	55
	Total	.3390	1.48345	165

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Level 2 vs. Level 1	.916	1	.916	.544	.462
time * group	Level 2 vs. Level 1	6.138	2	3.069	1.821	.165
Error(time)	Level 2 vs. Level 1	273.044	162	1.685		

Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	15.019	1	15.019	7.124	.008
group	7.916	2	3.958	1.877	.156
Error	341.520	162	2.108		

A.e Between groups (treatment group versus inconsistent group) comparison of mean life satisfaction in waves K and L

Group Statistics

	grouping	N	Mean	Std. Deviation	Std. Error Mean
AVG_LS_KL	Experimentalgruppe1	55	.1283	1.77606	.23948
	inconsistent group	55	.0459	1.87394	.25268

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					90% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AVG_LS_KL	Equal variances assumed	.105	.747	.237	108	.813	.08237	.34814	-.49522	.65996
	Equal variances not assumed			.237	107.691	.813	.08237	.34814	-.49524	.65997

A.f Between groups (treatment group versus inconsistent group) comparison of mean life satisfaction in waves M through P

Group Statistics

	grouping	N	Mean	Std. Deviation	Std. Error Mean
AVG_LS_MNOP	Experimentalgruppe1	55	.4722	1.33504	.18002
	inconsistent group	55	.0225	1.64755	.22216

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					90% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AVG_LS_MNOP	Equal variances assumed	1.654	.201	1.573	108	.119	.44976	.28594	-.02463	.92415
	Equal variances not assumed			1.573	103.551	.119	.44976	.28594	-.02481	.92433

A.g Between groups (treatment group versus sports group) comparison of mean life satisfaction in waves M through P

Group Statistics

	grouping	N	Mean	Std. Deviation	Std. Error Mean
AVG_LS_MNOP	Experimentalgruppe1	55	.4722	1.33504	.18002
	sports group	55	.5222	1.42560	.19223

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					90% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
AVG_LS_MNOP	Equal variances assumed	.355	.553	-.190	108	.850	-.05000	.26336	-.48693	.38693
	Equal variances not assumed			-.190	107.538	.850	-.05000	.26336	-.48695	.38695

A.h Treatment group within-subjects comparison of life satisfaction in physically inactive period (AVG_LS_KL) and in physically active period (AVG_LS_MNOP)

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	90% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	AVG_LS_MNOP - AVG_LS_KL	.34396	1.61318	.21752	-.02007	.70800	1.581	54	.120

A.i   Repeated measures ANOVA to investigate curve shape: Waves L through O

Within-Subjects Factors

Measure:MEASURE_1

time	Dependent Variable
1	L_centered
2	M_centered
3	N_centered
4	O_centered

Descriptive Statistics

	Mean	Std. Deviation	N
L_centered	.0768	2.14539	55
M_centered	.3383	1.51646	55
N_centered	.5511	1.55700	55
O_centered	.6491	1.66323	55

Mauchly's Test of Sphericity[b]

Measure:MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time	.585	28.266	5	.000	.722	.753	.333

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.
b. Design: Intercept
 Within Subjects Design: time

Tests of Within-Subjects Effects

Measure:MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	10.620	3	3.540	2.239	.086
	Greenhouse-Geisser	10.620	2.166	4.904	2.239	.107
	Huynh-Feldt	10.620	2.259	4.701	2.239	.104
	Lower-bound	10.620	1.000	10.620	2.239	.140
Error(time)	Sphericity Assumed	256.173	162	1.581		
	Greenhouse-Geisser	256.173	116.944	2.191		
	Huynh-Feldt	256.173	122.003	2.100		
	Lower-bound	256.173	54.000	4.744		

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	10.240	1	10.240	3.988	.051
	Quadratic	.368	1	.368	.301	.586
	Cubic	.012	1	.012	.013	.911
Error(time)	Linear	138.649	54	2.568		
	Quadratic	66.027	54	1.223		
	Cubic	51.496	54	.954		

Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	35.877	1	35.877	4.882	.031
Error	396.845	54	7.349		

A.j Repeated measures ANOVA to investigate curve shape: Waves L through P

Within-Subjects Factors

Measure:MEASURE_1

time	Dependent Variable
1	L_centered
2	M_centered
3	N_centered
4	O_centered
5	P_centered

Descriptive Statistics

	Mean	Std. Deviation	N
L_centered	.0768	2.14539	55
M_centered	.3383	1.51646	55
N_centered	.5511	1.55700	55
O_centered	.6491	1.66323	55
P_centered	.3503	1.72952	55

Mauchly's Test of Sphericity[b]

Measure:MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[a]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
time	.486	37.870	9	.000	.707	.750	.250

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.
b. Design: Intercept
 Within Subjects Design: time

Tests of Within-Subjects Effects

Measure:MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
time	Sphericity Assumed	10.746	4	2.686	1.669	.158
	Greenhouse-Geisser	10.746	2.828	3.800	1.669	.179
	Huynh-Feldt	10.746	3.000	3.582	1.669	.176
	Lower-bound	10.746	1.000	10.746	1.669	.202
Error(time)	Sphericity Assumed	347.578	216	1.609		
	Greenhouse-Geisser	347.578	152.693	2.276		
	Huynh-Feldt	347.578	162.004	2.145		
	Lower-bound	347.578	54.000	6.437		

Tests of Within-Subjects Contrasts

Measure:MEASURE_1

Source	time	Type III Sum of Squares	df	Mean Square	F	Sig.
time	Linear	4.048	1	4.048	1.378	.246
	Quadratic	5.996	1	5.996	3.592	.063
	Cubic	.666	1	.666	.741	.393
	Order 4	.037	1	.037	.039	.844
Error(time)	Linear	158.644	54	2.938		
	Quadratic	90.143	54	1.669		
	Cubic	48.538	54	.899		
	Order 4	50.254	54	.931		

Tests of Between-Subjects Effects

Measure:MEASURE_1
Transformed Variable:Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	42.502	1	42.502	4.915	.031
Error	466.967	54	8.648		

B   Gym study: documentation of the analyses

B.a   Screenshots of the questionnaire

Questions asked in all waves: resource gains, resource losses and level of weekly activity

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Seite 2/6

2. In welchen Bereichen haben Sie in den letzten 3-4 Wochen Verluste erlebt?

Im Folgenden sind die gleichen Ressourcen aufgelistet wie auf der vorangegangenen Seite. Bitte lesen Sie wieder jede Ressource sorgfältig durch und geben Sie diesmal an, wie stark Sie persönlich bei der jeweiligen Ressource Verluste erlebt haben—in den letzten **3-4 Wochen**. Wenn Sie bei einer Ressource keinerlei Verluste erlebt haben (oder die Ressource nicht zutrifft), wählen Sie bitte die hinterste Option „Kein Verlust / nicht zutreffend".

Es gibt keine richtigen oder falschen Antworten; nur Ihre persönliche Einschätzung ist wichtig.

Bitte bewerten Sie nun **nur** Ihre Verluste, unabhängig von den Zugewinnen. Es soll auch hier **kein** Durchschnitt gebildet werden.
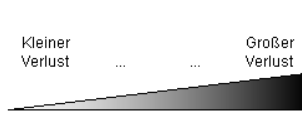
In den letzten 3-4 Wochen hatte ich Verluste bei...	Kleiner Verlust	...	...	Großer Verlust	Kein Verlust / nicht zutreffend
	1	2	3	4	
Hoffnung	○	○	○	○	○
Organisationsfähigkeit	○	○	○	○	○
Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	○	○	○	○	○
Engagement/Hingabe	○	○	○	○	○
Unterstützung bei Aufgaben im Beruf	○	○	○	○	○
Ausdauer/Geduld	○	○	○	○	○
Das Gefühl zu wissen wer ich bin	○	○	○	○	○
Zuneigung von anderen	○	○	○	○	○
Das Gefühl, dass ich Kontrolle über mein Leben habe	○	○	○	○	○
Vertrautheit mit mindestens einem Freund / einer Freundin	○	○	○	○	○

[...]

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Wie oft haben Sie in den letzten drei Wochen die folgenden körperlichen Aktivitäten ausgeübt?

1. Anstrengende körperliche Aktivität (erhöhte Anstrengung und Schwitzen)

Z.B. intensives Schwimmen, Jogging, Fußballspielen, Radsport

Wie oft pro Woche? [____] -mal pro Woche

Durchschnittliche Dauer pro Termin? [____] Minuten pro Termin

2. Mäßige körperliche Aktivität (kaum erhöhte Anstrengung und leichtes Schwitzen)

Z.B. schnelles Gehen, langsames Radfahren, langsames Schwimmen

Wie oft pro Woche? [____] -mal pro Woche

Durchschnittliche Dauer pro Termin? [____] Minuten pro Termin

3. Leichte körperliche Aktivität (keine erhöhte Anstrengung und kein Schwitzen)

Z.B. Golf, leichtes Gehen, Angeln

Wie oft pro Woche? [____] -mal pro Woche

Durchschnittliche Dauer pro Termin? [____] Minuten pro Termin

Control questions asked in the first wave only: exercise history and work situation

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Zum Schluss: bitte beantworten Sie noch die folgenden Fragen. Danach ist der Fragebogen beendet!

6. Haben Sie in der Vergangenheit regelmäßig Sport betrieben?

Diese Frage bezieht sich auf Ihr Sportverhalten in der Vergangenheit. Unter sportlicher Aktivität versteht man Tätigkeiten wie z.B. Joggen, Aerobic, Fußballspielen oder zügiges Radfahren, also eine Aktivität, die Ihre körperliche Fitness steigert und bei der Sie normalerweise ins Schwitzen geraten. Von regelmäßiger sportlicher Aktivität spricht man, wenn Sie diese Tätigkeit durchschnittlich 2-3 Mal pro Woche für mind. 20 Minuten oder 1 Mal pro Woche für mind. 60 Minuten betrieben haben.

Beurteilen Sie nun bitte, welche der folgenden Aussagen Ihr Sportverhalten in den letzten 6 Monaten am zutreffendsten beschreibt (nur 1 Auswahl möglich).

In den letzten 6 Monaten...

- ⚪ ...habe ich keinen regelmäßigen Sport betrieben.
- 🔘 ...habe ich Sport betrieben, aber nur unregelmäßig.
- ⚪ ...habe ich regelmäßig Sport betrieben – und innerhalb der letzten 6 Monate damit begonnen.
- ⚪ ...habe ich regelmäßig Sport betrieben – und zwar schon länger als 6 Monate.

7. Wie viel körperliche Bewegung beinhaltet Ihr Berufsalltag?

Mein Berufsalltag beinhaltet hauptsächlich... (nur 1 Auswahl möglich)

- 🔘 ...sitzende Tätigkeiten (z.B. Büro, Computer, Student, o.ä.)
- ⚪ ...mäßige Bewegung (z.B. Handwerker, Verkäufer, o.ä.)
- ⚪ ...intensive Bewegung (z.B. Postbote, Bauarbeiter, o.ä.)

B.b Translation of the COR-E into German

#	Original list of COR-E resources as proposed by Hobfoll et al. 1992	German translation
1	Personal transportation (car, truck, etc.)	Persönliche Mobilität (Auto, etc.)
2	Feeling that I am successful	Das Gefühl erfolgreich zu sein
3	Time for adequate sleep	Zeit für ausreichend Schlaf
4	Good marriage	Gute Ehe
5	Adequate clothing	Ausreichende Kleidung
6	Feeling valuable to others	Das Gefühl für andere wichtig/wertvoll zu sein
7	Family stability	Stabilität in der Familie
8	Intimacy with one or more family members	Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern
9	Clothing that is more than what I need	Kleidung, die über das Nötige hinausgeht
10	Sense of pride in myself	Das Gefühl auf mich stolz sein zu können
11	Free time	Freizeit
12	Time for work	Zeit für die Arbeit
13	Feeling that I am accomplishing my goals	Das Gefühl, dass ich meine Ziele erreiche
14	Hope	Hoffnung
15	Good relationship with my children	Gute Beziehung zu meinen Kindern
16	Time with loved ones	Zeit für gute Freunde, Familie und andere Nahestehende
17	Necessary tools for work	Notwendige Hilfsmittel/Werkzeuge für die Arbeit
18	Children's health	Gesundheit meiner Kinder
19	Stamina/endurance	Ausdauer/Geduld
20	Necessary appliances for home	Notwendige Haushaltsgeräte
21	Personal health	Meine eigene Gesundheit
22	Feeling my future success depends on me	Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt
23	Positively challenging routine	Positiv fordernder/anregender Tagesablauf
24	Housing that suits my needs	Wohnung/Haus, das meinen Bedürfnissen entspricht
25	Sense of optimism	Optimismus
26	Status/seniority at work	Status/Seniorität im Beruf
27	Adequate food	Ausreichendes/geeignetes Essen
28	Home that is more than what I need	Ein Zuhause, das über das Nötige hinausgeht
29	Stable employment	Dauerhaftes/festes Beschäftigungsverhältnis
30	Intimacy with spouse or partner	Vertrautheit/Intimität mit dem Partner
31	Adequate furnishings for home	Ausreichende/angemessene Einrichtung für das Zuhause
32	Feeling that I have control over my life	Das Gefühl, dass ich Kontrolle über mein

		Leben habe
33	Sense of humor	Sinn für Humor
34	Role as a leader	Eine Führungsrolle
35	Ability to communicate well	Kontaktfähigkeit
36	Essentials for children	Lebensnotwendige Dinge für meine Kinder
37	Feeling that my life is peaceful	Das Gefühl, dass mein Leben friedvoll ist
38	Acknowledgement for accomplishment	Anerkennung für meine Leistungen
39	Ability to organize tasks	Organisationsfähigkeit
40	"Extras" for children	"Extras" für meine Kinder
41	Sense of commitment	Engagement/Hingabe
42	Intimacy with at least one friend	Vertrautheit mit mindestens einem Freund / einer Freundin
43	Money for "extras"	Geld für "Extras"
44	Self-discipline	Selbstdisziplin
45	Understanding from my employer/boss	Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef
46	Companionship	Kameradschaft/Gemeinschaft/Gesellschaft
47	Savings of emergency money	Ersparnisse/Rücklagen für Notfälle
48	Motivation to get things done	Motivation etw. anzupacken/ getan zu bekommen
49	Spouse/partner's health	Gesundheit des Partners
50	Support from co-workers	Unterstützung von Kollegen
51	Adequate income	Ausreichendes/angemessenes Einkommen
52	Feeling that I know who I am	Das Gefühl zu wissen wer ich bin
53	Adequate credit (financial)	Ausreichend Kreditwürdigkeit (finanziell)
54	Feeling independent	Das Gefühl unabhängig/selbstständig zu sein
55	Financial assets (stocks, property, etc.)	Finanzielle Vermögenswerte (Wertpapiere, Eigentum, etc.)
56	Knowing where I am going with my life	Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben
57	Affection from others	Zuneigung von anderen
58	Financial stability	Finanzielle Stabilität
59	Feeling that my life has meaning or purpose	Das Gefühl, dass mein Leben Sinn/Bedeutung hat
60	Positive feelings about myself	Positive Gefühle gegenüber mir selbst
61	People I can learn from	Menschen von denen ich lernen kann
62	Money for transportation	Geld für Fahrten/Mobilität
63	Help with tasks at work	Unterstützung bei Aufgaben im Beruf
64	Medical insurance	Krankenversicherung
65	Involvement with church, synagogue, and so forth	Aktive Mitgliedschaft in einer Kirche, Synagoge, o.ä.
66	Retirement security (financial)	Altersvorsorge (finanziell)

67	Help with tasks at home	Unterstützung bei der Haushaltsarbeit
68	Loyalty of friends	Loyalität von Freunden
69	Help with childcare	Unterstützung bei der Kinderbetreuung
70	Financial help if needed	Finanzielle Unterstützung (nötigenfalls)
71	Health of family/close friends	Gesundheit der Familie / enger Freunde
72	Involvement in organizations with others who have similar interests	Aktive Mitgliedschaft in Vereinen/ Organisationen mit Menschen die meine Interessen teilen
73	Money for advancement of self-improvement (education, starting a business)	Geld für meine persönliche Weiterentwicklung/Selbstverwirklichung (z.B. Ausbildung, Existenzgründung)
74	Advancement in my education or training	Fortschritte in meiner Aus- oder Fortbildung

B.c   Results of the pretest

The following table specifies, which of the original 74 items of the COR-E have been included, and why. The decision has been based on a ranking of all items in wave one and two of the pre-test; the ranking of each item was calculated based on (a) the grand total of gains and losses for that item according to the rating scale ("Sum") and (b) the total of participants indicating any gains or losses for that item, i.e., rating losses or gains greater than '0' ("Count"). The "Result" column explicates, if the item has been included and why: e.g., "top 25" connotes that the item ranks among the top 25 items of both waves, "top 40 w1" connotes that the item ranks among the top 40 items of wave 1. All 34 items that have been selected are at least among the top 40 of one of the two waves, with one exception: item 72 (English: "involvement in organizations with others who have similar interests") has been included for its relevance in the context of fitness club memberships.

#	Item	Wave 1					Wave 2					Result
		Rank	Gains Sum	Count	Losses Sum	Count	Rank	Gains Sum	Count	Losses Sum	홍핚	
01	Persönliche Mobilität (Auto, etc.)	51	11	5	9	4	42	4	3	4	1	*excluded*
02	Das Gefühl erfolgreich zu sein	1	39	20	10	6	1	13	9	1	1	top 25
03	Zeit für ausreichend Schlaf	13	13	5	24	14	2	9	5	5	5	top 25
04	Gute Ehe	32	29	9	0	0	39	8	5	0	0	*excluded*
05	Ausreichende Kleidung	48	18	9	3	2	51	5	4	0	0	*excluded*
06	Das Gefühl für andere wichtig/ wertvoll zu sein	3	41	19	5	4	4	12	10	1	1	top 25
07	Stabilität in der Familie	37	24	10	4	4	31	4	4	4	3	*excluded*
08	Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	39	26	14	1	1	13	9	7	2	2	top 25 w2
09	Kleidung, die über das Nötige hinausgeht	49	19	9	1	1	32	7	6	1	1	*excluded*
10	Das Gefühl auf mich stolz sein zu können	4	39	19	6	4	5	11	9	2	2	top 25
11	Freizeit	7	18	9	24	15	9	10	7	2	2	top 25
12	Zeit für die Arbeit	31	25	12	5	5	21	7	5	2	2	top 25 w2

#	Item	Wave 1					Wave 2					Result
		Rank	Gains Sum	Count	Losses Sum	Count	Rank	Gains Sum	Count	Losses Sum	Count	
13	Das Gefühl, dass ich meine Ziele erreiche	9	32	19	8	5	11	12	8	0	0	top 25
14	Hoffnung	17	29	14	5	3	53	4	4	0	0	top 25 w1
15	Gute Beziehung zu meinen Kindern	68	4	1	2	1	63	0	0	2	1	excluded
16	Zeit für gute Freunde, Familie und andere Nahestehende	2	23	12	25	13	6	10	6	3	2	top 25
17	Notwendige Hilfsmittel/ Werkzeuge für die Arbeit	54	16	9	2	1	40	8	5	0	0	excluded
18	Gesundheit meiner Kinder	71	3	1	0	0	66	0	0	0	0	excluded
19	Ausdauer/Geduld	19	24	14	9	6	36	4	4	4	2	top 25 w1
20	Notwendige Haushaltsgeräte	67	4	3	2	1	67	0	0	0	0	excluded
21	Meine eigene Gesundheit	15	22	11	12	8	19	3	3	6	5	top 25
22	Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	12	33	16	4	4	14	10	7	1	1	top 25
23	Positiv fordernder/anregender Tagesablauf		34	18	9	6	3	12	8	2	2	top 25
24	Wohnung/Haus, das meinen Bedürfnissen entspricht	52	15	7	4	3	30	9	4	0	0	excluded
25	Optimismus	16	28	14	6	5	16	11	7	0	0	top 25
26	Status/Seniorität im Beruf	42	21	12	4	4	22	7	6	2	1	excluded
27	Ausreichendes/geeignetes Essen	25	25	10	7	6	26	8	5	1	1	excluded
28	Ein Zuhause, das über das Nötige hinausgeht	50	18	9	2	1	27	9	6	0	0	excluded
29	Dauerhaftes/festes Beschäftigungsverhältnis	61	12	5	2	2	60	2	2	0	0	excluded
30	Vertrautheit/Intimität mit dem Partner	29	31	12	0	0	33	7	6	1	1	top 30 w1
31	Ausreichende/angemessene Einrichtung für das Zuhause	53	15	7	4	2	45	6	3	1	1	excluded
32	Das Gefühl, dass ich Kontrolle über mein Leben habe	20	25	13	8	6	8	10	8	2	2	top 25
33	Sinn für Humor	59	13	6	2	2	49	4	4	1	1	excluded
34	Eine Führungsrolle	41	23	11	3	2	23	8	6	1	1	excluded
35	Kontaktfähigkeit	45	23	15	1	1	34	7	6	1	1	top 40 w2
36	Lebensnotwendige Dinge für meine Kinder	74	1	1	0	0	68	0	0	0	0	excluded
37	Das Gefühl, dass mein Leben friedvoll ist	36	22	10	6	5	47	3	3	3	2	excluded

#	Item	Wave 1					Wave 2					Result
		Rank	Gains Sum	Count	Losses Sum	Count	Rank	Gains Sum	Count	Losses Sum	Count	
38	Anerkennung für meine Leistungen	6	36	17	7	4	10	12	9	0	0	top 25
39	Organisationsfähigkeit	27	31	15	0	0	54	4	4	0	0	top 30 w1
40	"Extras" für meine Kinder	72	2	1	0	0	69	0	0	0	0	*excluded*
41	Engagement/Hingabe	18	30	13	4	3	44	7	5	0	0	top 25 w1
42	Vertrautheit mit mindestens einem Freund / einer Freundin	8	40	18	1	1	20	9	8	0	0	top 25
43	Geld für "Extras"	26	26	12	5	4	43	6	5	1	1	*excluded*
44	Selbstdisziplin	34	25	14	3	2	46	6	3	1	1	top 40 w1
45	Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef	23	22	11	10	8	12	9	6	3	2	or>Loe
46	Kameradschaft/Gemeinschaft/ Gesellschaft	22	26	15	6	5	15	7	5	4	3	top 25
47	Ersparnisse/Rücklagen für Notfälle	38	23	14	4	3	24	6	5	3	2	*excluded*
48	Motivation etw. anzupacken/ getan zu bekommen	14	33	16	4	3	7	11	6	2	2	top 25
49	Gesundheit des Partners	62	12	5	2	2	57	1	1	2	2	*excluded*
50	Unterstützung von Kollegen	30	24	16	6	4	37	8	6	0	0	*excluded*
51	Ausreichendes/angemessenes Einkommen	60	13	7	1	1	58	2	2	1	1	*excluded*
52	Das Gefühl zu wissen wer ich bin	24	27	14	5	4	41	8	5	0	0	top 25 w1
53	Ausreichend Kreditwürdigkeit (finanziell)	46	22	13	1	1	61	2	2	0	0	*excluded*
54	Das Gefühl unabhängig/selbstständig zu sein	33	27	16	1	1	28	9	6	0	0	top 30 w2
55	Finanzielle Vermögenswerte (Wertpapiere, Eigentum, etc.)	65	9	4	0	0	52	4	2	1	1	*excluded*
56	Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	11	36	14	2	2	17	11	5	0	0	top 25
57	Zuneigung von anderen	21	28	16	5	3	35	7	6	1	1	top 25 w1
58	Finanzielle Stabilität	47	21	11	1	1	55	4	4	0	0	*excluded*
59	Das Gefühl, dass mein Leben Sinn/Bedeutung hat	28	29	12	2	2	38	8	6	0	0	top 40
60	Positive Gefühle gegenüber mir selbst	10	30	13	8	6	18	9	6	1	1	top 25
61	Menschen von denen ich lernen kann	35	26	14	2	2	29	9	5	0	0	top 30 w2
62	Geld für Fahrten/Mobilität	56	17	8	1	1	64	1	1	0	0	*excluded*

#	Item	Wave 1					Wave 2					Result
		Rank	Gains Sum	Count	Losses Sum	Count	Rank	Gains Sum	Count	Losses Sum	Count	
63	Unterstützung bei Aufgaben im Beruf	43	19	12	6	4	25	7	5	2	2	*excluded*
64	Krankenversicherung	64	4	3	5	2	70	0	0	0	0	*excluded*
65	Aktive Mitgliedschaft in einer Kirche, Synagoge, o.ä.	69	5	2	0	0	71	0	0	0	0	*excluded*
66	Altersvorsorge (finanziell)	55	16	8	2	2	62	1	1	1	1	*excluded*
67	Unterstützung bei der Haushaltsarbeit	63	7	4	2	2	72	0	0	0	0	*excluded*
68	Loyalität von Freunden	40	23	13	4	2	48	5	4	1	1	*excluded*
69	Unterstützung bei der Kinderbetreuung	73	2	1	0	0	73	0	0	0	0	*excluded*
70	Finanzielle Unterstützung (nötigenfalls)	70	4	2	0	0	74	0	0	0	0	*excluded*
71	Gesundheit der Familie / enger Freunde	57	12	6	5	3	59	0	0	3	2	*excluded*
72	Aktive Mitgliedschaft in Vereinen/ Organisationen mit Menschen, die meine Interessen teilen	66	7	5	0	0	56	3	2	1	1	exercise-related
73	Geld für meine persönliche Weiterentwicklung/ Selbstverwirklichung (z.B. Ausbildung, Existenzgründung)	58	16	8	0	0	65	1	1	0	0	*excluded*
74	Fortschritte in meiner Aus- oder Fortbildung	44	25	14	0	0	50	5	5	0	0	*excluded*

B.d   Subject participation and attrition

Subject ID ▼	Wave01	Wave02	Wave03	Wave04	Wave05	Grand Total
MG063778	1	1	1	1	1	5
HO866813	1	1	1	1	1	5
PO489990	1	1	1	1	1	5
CG190013	1	1	1	1	1	5
KH151097	1	1	1	1	1	5
ED939319	1	1	1	1	1	5
NE280162	1	1	1	1	1	5
EZ204941	1	1	1	1	1	5
TU224141	1	1	1	1	1	5
FO939271	1	1	1	1	1	5
JY697101	1	1	1	1	1	5
XA428409	1	1		1	1	4
GG883401	1	1	1	1		4
VL158865	1	1	1	1		4
UQ023929	1	1	1			3
EB758053	1	1	1			3
ZT217357	1		1		1	3
XY312001	1	1	1			3
PP269182	1	1	1			3
CQ692594	1		1	1		3
NY344530	1	1	1			3
HZ618582	1	1				2
ZT294286	1	1				2
YD012725	1	1				2
AD881492	1	1				2
TX657755	1	1				2
OV487430	1	1				2
DB702537	1			1		2
BL477521	1	1				2
HT812797	1	1				2
HW797603	1	1				2
FJ379310	1					1
ZE367349	1					1
TR275090	1					1
OS507330	1					1
QF120146	1					1
TV948483	1					1
KW704174	1					1
OL575433	1					1
YH921317	1					1
UI204691	1					1
DV803878	1					1
PZ747844	1					1
AK554410	1					1
TU801878	1					1
Grand Total	**45**	**28**	**20**	**16**	**13**	**122**

A highlighted field indicates that the questionnaire has not been finished.

B.e T-test to compare the resource gains in the first waves of the gym sample and the pretest sample

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
mean_RG_W1	Gym sample	45	1.8471	.78837	.11752
	Pretest sample	21	1.1905	.77614	.16937

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
mean_RG_W1	Equal variances assumed	.050	.824	3.167	64	.002	.65658	.20734	.24237	1.07079
	Equal variances not assumed			3.185	39.712	.003	.65658	.20615	.23985	1.07332

B.f Principal component analyses of resource gains in wave one

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.686
Bartlett's Test of Sphericity	Approx. Chi-Square	1131.805
	df	561
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	12.081	35.533	35.533	12.081	35.533	35.533	11.102
2	3.520	10.354	45.887	3.520	10.354	45.887	8.647
3	2.321	6.826	52.713				
4	2.009	5.908	58.621				
5	1.563	4.597	63.218				
6	1.419	4.174	67.392				
7	1.271	3.737	71.130				
8	1.148	3.377	74.506				
9	.994	2.925	77.431				
10	.948	2.788	80.220				
11	.842	2.477	82.697				
12	.690	2.029	84.725				
13	.665	1.957	86.682				
14	.611	1.797	88.479				
15	.586	1.725	90.204				
16	.512	1.507	91.710				
17	.395	1.162	92.872				
18	.332	.975	93.847				
19	.299	.881	94.728				
20	.277	.815	95.543				
21	.266	.784	96.326				
22	.221	.651	96.977				
23	.190	.557	97.534				
24	.158	.464	97.998				
25	.126	.369	98.367				
26	.107	.313	98.681				
27	.095	.281	98.961				
28	.087	.255	99.216				
29	.070	.206	99.423				
30	.059	.173	99.596				
31	.050	.148	99.743				
32	.045	.133	99.876				
33	.025	.075	99.950				
34	.017	.050	100.000				

Extraction Method: Principal Component Analysis.

a. When components are correlated, sums of squared loadings cannot be added to obtain a total variance.

Component Correlation Matrix

Component	1	2
1	1.000	.514
2	.514	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Communalities

	Initial	Extraction
RG01_01.Wave01: Hoffnung	1.000	.386
RG01_02.Wave01: Organisationsfähigkeit	1.000	.174
RG01_03.Wave01: Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	1.000	.332
RG01_04.Wave01: Engagement/Hingabe	1.000	.388
RG01_05.Wave01: Ausdauer/Geduld	1.000	.581
RG01_06.Wave01: Das Gefühl zu wissen wer ich bin	1.000	.352
RG01_07.Wave01: Zuneigung von anderen	1.000	.371
RG01_08.Wave01: Das Gefühl, dass ich Kontrolle über mein Leben habe	1.000	.514
RG01_09.Wave01: Vertrautheit mit mindestens einem Freund / einer Freundin	1.000	.576
RG01_10.Wave01: Selbstdisziplin	1.000	.658
RG01_11.Wave01: Zeit für ausreichend Schlaf	1.000	.131
RG01_12.Wave01: Kontaktfähigkeit	1.000	.316
RG01_13.Wave01: Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef	1.000	.203
RG01_14.Wave01: Zeit für die Arbeit	1.000	.561
RG01_15.Wave01: Das Gefühl, dass mein Leben Sinn/Bedeutung hat	1.000	.489
RG01_16.Wave01: Aktive Mitgliedschaft in Vereinen/ Organisationen mit Menschen, die meine Interessen teilen	1.000	.263
RG01_17.Wave01: Positive Gefühle gegenüber mir selbst	1.000	.535
RG01_18.Wave01: Kameradschaft/Gemeinschaft/Gesellschaft	1.000	.707
RG01_19.Wave01: Motivation etw. anzupacken/ getan zu bekommen	1.000	.587
RG01_20.Wave01: Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	1.000	.593
RG01_21.Wave01: Menschen von denen ich lernen kann	1.000	.225
RG01_22.Wave01: Das Gefühl unabhängig/selbstständig zu sein	1.000	.540
RG01_23.Wave01: Zeit für gute Freunde, Familie und andere Nahestehende	1.000	.656
RG01_24.Wave01: Meine eigene Gesundheit	1.000	.465
RG01_25.Wave01: Vertrautheit/Intimität mit dem Partner	1.000	.208
RG01_26.Wave01: Anerkennung für meine Leistungen	1.000	.326
RG01_27.Wave01: Freizeit	1.000	.399
RG01_28.Wave01: Das Gefühl, dass ich meine Ziele erreiche	1.000	.744
RG01_29.Wave01: Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	1.000	.414
RG01_30.Wave01: Positiv fordernder/anregender Tagesablauf	1.000	.595
RG01_31.Wave01: Das Gefühl für andere wichtig/wertvoll zu sein	1.000	.578
RG01_32.Wave01: Das Gefühl auf mich stolz sein zu können	1.000	.590
RG01_33.Wave01: Das Gefühl erfolgreich zu sein	1.000	.500
RG01_34.Wave01: Optimismus	1.000	.644

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component	
	1	2
RG01_28.Wave01: Das Gefühl, dass ich meine Ziele erreiche	.838	-.206
RG01_30.Wave01: Positiv fordernder/anregender Tagesablauf	.765	
RG01_34.Wave01: Optimismus	.755	-.272
RG01_19.Wave01: Motivation etw. anzupacken/ getan zu bekommen	.753	
RG01_31.Wave01: Das Gefühl für andere wichtig/wertvoll zu sein	.739	
RG01_17.Wave01: Positive Gefühle gegenüber mir selbst	.729	
RG01_20.Wave01: Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	.728	.250
RG01_32.Wave01: Das Gefühl auf mich stolz sein zu können	.691	-.335
RG01_24.Wave01: Meine eigene Gesundheit	.681	
RG01_08.Wave01: Das Gefühl, dass ich Kontrolle über mein Leben habe	.680	-.226
RG01_22.Wave01: Das Gefühl unabhängig/selbstständig zu sein	.680	.278
RG01_18.Wave01: Kameradschaft/Gemeinschaft/Gesellschaft	.674	.503
RG01_05.Wave01: Ausdauer/Geduld	.671	-.361
RG01_15.Wave01: Das Gefühl, dass mein Leben Sinn/Bedeutung hat	.659	-.235
RG01_33.Wave01: Das Gefühl erfolgreich zu sein	.649	-.281
RG01_10.Wave01: Selbstdisziplin	.646	-.490
RG01_23.Wave01: Zeit für gute Freunde, Familie und andere Nahestehende	.614	.528
RG01_04.Wave01: Engagement/Hingabe	.594	
RG01_26.Wave01: Anerkennung für meine Leistungen	.571	
RG01_29.Wave01: Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	.570	-.298
RG01_06.Wave01: Das Gefühl zu wissen wer ich bin	.561	
RG01_14.Wave01: Zeit für die Arbeit	.550	.509
RG01_16.Wave01: Aktive Mitgliedschaft in Vereinen/ Organisationen mit Menschen, die meine Interessen teilen	.512	
RG01_12.Wave01: Kontaktfähigkeit	.471	.307
RG01_07.Wave01: Zuneigung von anderen	.460	.399
RG01_21.Wave01: Menschen von denen ich lernen kann	.436	
RG01_13.Wave01: Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef	.412	
RG01_02.Wave01: Organisationsfähigkeit	.382	
RG01_25.Wave01: Vertrautheit/Intimität mit dem Partner	.379	.253
RG01_09.Wave01: Vertrautheit mit mindestens einem Freund / einer Freundin	.426	.628
RG01_27.Wave01: Freizeit	.341	.532
RG01_01.Wave01: Hoffnung	.422	-.457
RG01_03.Wave01: Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	.387	.426
RG01_11.Wave01: Zeit für ausreichend Schlaf		.308

Extraction Method: Principal Component Analysis.

a. 2 components extracted.

Pattern Matrix[a]

	Component	
	1	2
RG01_10.Wave01: Selbstdisziplin	.920	-.283
RG01_05.Wave01: Ausdauer/Geduld	.822	
RG01_32.Wave01: Das Gefühl auf mich stolz sein zu können	.812	
RG01_28.Wave01: Das Gefühl, dass ich meine Ziele erreiche	.805	
RG01_34.Wave01: Optimismus	.803	
RG01_33.Wave01: Das Gefühl erfolgreich zu sein	.732	
RG01_01.Wave01: Hoffnung	.723	-.335
RG01_08.Wave01: Das Gefühl, dass ich Kontrolle über mein Leben habe	.706	
RG01_15.Wave01: Das Gefühl, dass mein Leben Sinn/Bedeutung hat	.698	
RG01_29.Wave01: Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	.690	
RG01_19.Wave01: Motivation etw. anzupacken/ getan zu bekommen	.683	
RG01_30.Wave01: Positiv fordernder/anregender Tagesablauf	.650	
RG01_04.Wave01: Engagement/Hingabe	.609	
RG01_17.Wave01: Positive Gefühle gegenüber mir selbst	.594	.220
RG01_06.Wave01: Das Gefühl zu wissen wer ich bin	.588	
RG01_21.Wave01: Menschen von denen ich lernen kann	.491	
RG01_24.Wave01: Meine eigene Gesundheit	.473	.306
RG01_26.Wave01: Anerkennung für meine Leistungen	.442	.201
RG01_02.Wave01: Organisationsfähigkeit	.434	
RG01_16.Wave01: Aktive Mitgliedschaft in Vereinen/ Organisationen mit Menschen, die meine Interessen teilen	.407	
RG01_09.Wave01: Vertrautheit mit mindestens einem Freund / einer Freundin	-.252	.857
RG01_23.Wave01: Zeit für gute Freunde, Familie und andere Nahestehende		.822
RG01_18.Wave01: Kameradschaft/Gemeinschaft/Gesellschaft		.817
RG01_14.Wave01: Zeit für die Arbeit		.775
RG01_27.Wave01: Freizeit	-.228	.718
RG01_03.Wave01: Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern		.620
RG01_07.Wave01: Zuneigung von anderen		.619
RG01_22.Wave01: Das Gefühl unabhängig/selbstständig zu sein	.252	.573
RG01_20.Wave01: Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	.313	.561
RG01_12.Wave01: Kontaktfähigkeit		.523
RG01_31.Wave01: Das Gefühl für andere wichtig/wertvoll zu sein	.386	.485
RG01_25.Wave01: Vertrautheit/Intimität mit dem Partner		.427
RG01_11.Wave01: Zeit für ausreichend Schlaf		.413
RG01_13.Wave01: Verständnis/Einvernehmen mit meinem Arbeitgeber/Chef		.364

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Structure Matrix

	Component	
	1	2
RG01_28.Wave01: Das Gefühl, dass ich meine Ziele erreiche	.858	.518
RG01_34.Wave01: Optimismus	.802	.412
RG01_10.Wave01: Selbstdisziplin	.774	
RG01_32.Wave01: Das Gefühl auf mich stolz sein zu können	.763	.323
RG01_19.Wave01: Motivation etw. anzupacken/ getan zu bekommen	.756	.494
RG01_05.Wave01: Ausdauer/Geduld	.754	.291
RG01_30.Wave01: Positiv fordernder/anregender Tagesablauf	.752	.532
RG01_08.Wave01: Das Gefühl, dass ich Kontrolle über mein Leben habe	.716	.383
RG01_17.Wave01: Positive Gefühle gegenüber mir selbst	.707	.525
RG01_33.Wave01: Das Gefühl erfolgreich zu sein	.705	.324
RG01_15.Wave01: Das Gefühl, dass mein Leben Sinn/Bedeutung hat	.699	.361
RG01_29.Wave01: Das Gefühl, dass mein zukünftiger Erfolg von mir selbst abhängt	.638	.253
RG01_24.Wave01: Meine eigene Gesundheit	.630	.549
RG01_04.Wave01: Engagement/Hingabe	.623	.340
RG01_06.Wave01: Das Gefühl zu wissen wer ich bin	.593	.312
RG01_01.Wave01: Hoffnung	.551	
RG01_26.Wave01: Anerkennung für meine Leistungen	.545	.428
RG01_16.Wave01: Aktive Mitgliedschaft in Vereinen/ Organisationen mit Menschen, die meine Interessen teilen	.493	.376
RG01_21.Wave01: Menschen von denen ich lernen kann	.474	.219
RG01_02.Wave01: Organisationsfähigkeit	.416	
RG01_18.Wave01: Kameradschaft/Gemeins chaft/Gesellschaft	.464	.840
RG01_23.Wave01: Zeit für gute Freunde, Familie und andere Nahestehende	.399	.810
RG01_14.Wave01: Zeit für die Arbeit	.345	.748
RG01_09.Wave01: Vertrautheit mit mindestens einem Freund / einer Freundin		.728
RG01_20.Wave01: Wissen, was ich in meinem Leben erreichen möchte / einen Lebensplan zu haben	.601	.722
RG01_22.Wave01: Das Gefühl unabhängig/selbstständi g zu sein	.546	.702
RG01_31.Wave01: Das Gefühl für andere wichtig/wertvoll zu sein	.636	.684
RG01_07.Wave01: Zuneigung von anderen	.298	.609
RG01_27.Wave01: Freizeit		.600
RG01_03.Wave01: Vertrautheit/Innigkeit mit einem oder mehreren Familienmitgliedern	.220	.570
RG01_12.Wave01: Kontaktfähigkeit	.340	.559
RG01_25.Wave01: Vertrautheit/Intimität mit dem Partner	.271	.454
RG01_13.Wave01: Verständnis/Einvernehme n mit meinem Arbeitgeber/Chef	.326	.435
RG01_11.Wave01: Zeit für ausreichend Schlaf		.342

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.