LATE-LIFE DEVELOPMENT OF PERSONAL LIFE INVESTMENT

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ABSTRACT

Striving for personal goals is one important aspect of composing one’s life within a developmental context, regardless of one’s age (Staudinger, 1999b). In this realm, personal life investment (PLI) measures the motivational intensity during goal striving or, more specifically, the amount of energy and effort that people report investing in central life domains (e.g., health, leisure, friends, family, independence). These investment ratings give information about the average amount of engagement in goal-related action and thought (average PLI) as well as the distribution of motivational energy across life domains (PLI selectivity).

It is important to study self-regulatory processes as facilitated and constrained by interactions among mental, biological, and behavioral factors within the individual and interactions between the individual and the environment. The impact of developmental contexts on the content of personal goals has been discussed and studied previously (e.g., Cantor, 1994; Freund, 2003; Nurmi, 1992). In contrast, the influence of contexts on self-regulatory processes during goal striving and the functionality of goal investment has been considered less often. In this dissertation, I have differentiated between obligatory PLI and optional PLI to stress this contextual impact on self-regulatory processes in old and very old age. Obligatory PLI is very much constrained by the age-graded demands of one’s developmental ecology. It reflects where older adults need to invest energy in order to maintain a basis for their development. In contrast, optional PLI allows for many more degrees of freedom as to where and when to invest.

This study was conducted with cross-sectional and longitudinal data from the Berlin Aging Study (BASE; P. B. Baltes & Mayer, 1999), a study of the lives of the old and oldest old (70 to over 100 years) including five measurement occasions across 10 years. Three overarching research questions guided my analyses: (1) How is PLI related to other elements of the dynamic self-system? (2) How do average PLI, PLI selectivity, obligatory PLI, and optional PLI develop across time and age during late life and how are developmental changes in obligatory PLI and optional PLI interrelated? (3) Does PLI contribute to successful aging, that is, high levels of satisfaction with one’s life and aging despite age-related losses and functional impairments?

The results showed that average PLI, obligatory PLI, and optional PLI, but not PLI selectivity, were related to various self-system variables, that is, personality dispositions, current and possible selves, and everyday activities. Specifically, personality dispositions and self-concepts showed unique associations with average PLI and obligatory PLI, and personality dispositions and activities showed unique associations with optional PLI. In addition, obligatory PLI and average PLI were linked to self and personality variables that are indicative of a tendency to engage with life in positive ways but also to variables indicative of more negative ways of
engaging with life. Both were positively related to positive affectivity, extraversion, and hoped-for possible selves as well as negative affectivity, neuroticism, and feared possible selves. In contrast, optional PLI was only related to positive ways of engaging with life.

With regard to developmental trends, optional PLI was the only PLI facet that demonstrated reliable decline between age 70 and 100. With dwindling resources that require more selective investments, old people, as a group, reduced optional PLI while maintaining their obligatory investments. Specifically, the reduction of optional PLI started around age 80, when many individuals enter the fourth age (e.g., P. B. Baltes & Smith, 1999, 2003). During the nineties, optional PLI stabilized again on a lower level. Obligatory PLI was stable across the entire age range. Average PLI (necessarily) showed a developmental trajectory in between the two PLI facets: A slight decline during the eighth decade of life with stability before and after this decade. PLI selectivity did not demonstrate reliable age-related change. Nevertheless, it was true of all four PLI facets that intraindividual change patterns varied, that is, some individuals showed decline, some stability, and some even increases in PLI facets despite the described group patterns. Goal-disengagement thus is a process that is characteristic only of PLI in some optional life domains and of many, but not all, older adults. Old people did not disengage from obligatory pursuits. As to interrelations between obligatory PLI and optional PLI, a contemporaneous effect of change in obligatory PLI on change in optional PLI was found, but no reciprocal path from change in optional PLI to change in obligatory PLI. That is, a reduction of obligatory PLI was linked to a reduction in optional PLI, but reducing optional PLI did not affect change in obligatory PLI. Due to large time intervals between measurement occasions there were no cross-lagged associations between change in obligatory PLI and change in optional PLI.

When only initial levels of PLI, functional health, and satisfaction at T1 were considered, results showed that optional PLI was the only PLI facet that was positively related to satisfaction after controlling for functional health. Optional PLI thus contributed to successful aging. More importantly, the previously documented moderating role of average PLI on the relationship between functional health and satisfaction (Staudinger & Fleson, 1996; Staudinger, Freund, Linden, & Maas, 1999) was replicated and extended. It was found that this moderating function is attributable to the role of optional PLI, but not present with obligatory PLI. When optional PLI was low, poor functional health had little impact on satisfaction but when optional PLI was high, poor health was associated with low satisfaction. Thus, not a high level of optional PLI per se but optional PLI that was matched with one’s resources contributed to successful aging. In contrast to the findings for initial levels, the moderating role of optional PLI and average PLI on the association between health and satisfaction was not demonstrated with the longitudinal data on
change in these variables. This was probably due to little change in functional health and PLI in longitudinal survivors.

Overall, this study shed more light on the functionality and development of personal life investment in old and very old age. The distinction between obligatory PLI and optional PLI and their consideration in addition to the overall engagement with life and the distribution of energy across life domains proved very useful to understand the multidirectionality and multifunctionality of personal life investment. Even in very old age, people continue to do what needs to be done, if at all possible. They are further motivated to do more than needs to be done and also engage in more optional pursuits in late life. This kind of investment contributes to their subjective well-being, unless their health is very poor. Disengagement is evident only in some life domains and contributes to successful aging when functional limitations become severe.
KURZFASSUNG


Diese Studie basiert auf Quer- und Längsschnittdaten der Berliner Altersstudie (BASE; P. B. Baltes & Mayer, 1999), einer interdisziplinären Studie, die sich der intensiven Erforschung alter Menschen (70 bis über 100 Jahre) gewidmet hat. Die Studienteilnehmer wurden über einen Zeitraum von zehn Jahren bis zu fünfmal untersucht. Drei zentrale Fragestellungen standen im Mittelpunkt dieser Arbeit: (1) Welche Beziehungen bestehen zwischen den vier Facetten des PLI (mittleres PLI, PLI Selektivität, obligatorisches PLI, optionales PLI) und anderen Konstrukten, die dem „Selbstsystem“ zuzurechnen sind, welches eine zentrale Rolle bei der Lebensgestaltung spielt? (2) Wie entwickeln sich die vier PLI Facetten während der zehn Jahre in BASE und über
Kurzfassung


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A INTRODUCTION

Actions and thoughts are central constructs in psychology. For researchers interested in the “what,” “why,” and “how” of behavior they represent entities localized at the bottom of a hierarchical structure depicting self-concepts, personality, motivation, or personal goals (e.g., Carver & Scheier, 1998; Costa & McCrae, 1997; Epstein, 1973; Mischel, 2004; Vallacher & Wegner, 1987; von Cranach, Kalbematten, Indermühl, & Gugler, 1982; Winell, 1987). In act-frequency approaches to personality (e.g., D. M. Buss & Craik, 1983) or motivation (e.g., Piedmont, 1989) dispositional attributions are based on summary statements about someone’s behavior. Alternatively, and this is the perspective of this dissertation, actions and thoughts can be conceptualized as basic elements of life composition (Staudinger, 1999b). That is, actions and thoughts are linked to goals that serve to master one’s life within a developmental context (see also Brandtstädter, 1998; Brandtstädter & Lerner, 1999; J. Heckhausen & Dweck, 1998). In this realm, the construct “personal life investment” (PLI; Staudinger & Fleeson, 1996; Staudinger, Freund, Linden, & Maas, 1999) has been devised as a measure of the intensity (see also Hyland, 1988) or the “how much” of goal-oriented behavior (action and thought) in various life domains, such as health, family, or leisure.

From a dispositional perspective, the observation that a woman eats a healthy diet once a month and goes for a walk ten times per year would probably lead to the conclusion that eating a healthy diet or going for walks is not important to this woman. This might further mean that she is not very interested in her health and, in general, does not engage in many health-related behaviors. From the perspective of life composition, matters are viewed as more complicated. If one asks about the developmental context of this woman, one may learn that she is 85 years old and has some trouble with preparing meals and walking. Now, it seems likely that she actually is interested in these activities but lacks the resources to engage in them more often and is not very successful at organizing help with them. And if asked about her goals, she would maybe say that staying as healthy and high-functioning as possible is among her top priorities.

The concept of life composition originated from a lifespan perspective (e.g., P. B. Baltes, Lindenberger, & Staudinger, 1998) and stresses that we can talk about and judge behavior only if we consider the constellation of resources and risks confronting an individual (Staudinger, 1999b; Staudinger & Greve, 2001). Thus, in order to understand behavior, we need to take into account the person’s developmental context in addition to more or less stable dispositions. For the study of life composition, we further need to know about a person’s goals. Often, what a person is doing or trying to do is obvious only for those who know about the person’s goals.

The focus of this dissertation is on the personal life investment or the “how much” of action and thought of old and very old people in various life domains, as conceptualized within
the perspective of life composition. PLI was assessed in the Berlin Aging Study (BASE; P. B. Baltes & Mayer, 1999) as the self-perceived amount of energy (action, thought) that is invested in ten central life domains (health, cognitive fitness, leisure, friends, sexuality, family, occupation or similar activities, independence, life reflection, and one’s death and dying) in order to pursue goals, maintain prior achievements, or regulate unrecoverable losses (Staudinger & Fleeson, 1996; Staudinger et al., 1999). When we ask old people to rate their domain-specific personal life investment, they are free to judge which behaviors belong to a specific goal domain and to employ their own criteria about what can be considered “much” investment. Additionally, PLI allows the capture of all phases and facets of the motivational process, that is, goal selection, planning, and disengagement from blocked goals in addition to actual goal pursuit (Staudinger & Schindler, 2005). In averaging across the ten life domains, an index of how much people invest in their life overall, or their engagement with life, can be derived. Old age is often depicted as a period of life when disengagement (Cumming & Henry, 1961) and inactivity rather than active engagement with life are the prevalent themes. Nevertheless, there are also theories that propose that staying active is essential to old people’s sense of well-being. Activity theory (e.g., Havighurst, 1961; Havighurst, Neugarten, & Tobin, 1968; Lemon, Bengtson, & Peterson, 1972) posits that older individuals benefit from developing new roles and commitments that allow for some continuity in societal participation and the expression of one’s dispositions (see also Atchley, 1989). Accordingly, considerable stability of PLI in old age has been documented with cross-sectional BASE data (Staudinger & Fleeson, 1996; Staudinger et al., 1999). Similarly, BASE data pointed to stable internal control beliefs during old age (Kunzmann, Little, & Smith, 2002). These findings again show that old age is not necessarily associated with losses in self and personality functioning (e.g., Smith & Baltes, 1999; Staudinger, Marsiske, & Baltes, 1993, 1995).

The present study is based on cross-sectional and longitudinal BASE data and provides a more detailed examination of the nature and development of personal life investment in old and very old age. It investigates the relationship between PLI and other elements of life composition, the development of PLI, and the functionality of PLI in contributing to successful aging. Besides average PLI, the variability of investment across the ten life domains is studied as an index of PLI selectivity. The model of selection, optimization, and compensation (SOC model; e.g., P. B. Baltes & Baltes, 1990; Freund & Baltes, 2000) has highlighted the adaptive value of becoming more selective during old age.

Average PLI was further divided into two facets of personal life investment to arrive at a more detailed understanding of the functionality of and late-life changes in engagement with life: obligatory PLI and optional PLI. The notion that development is the result of a complex interaction between person and environment, or more specifically, biology, culture, and a person’s
proactive attempts at developmental regulation (e.g., P. B. Baltes et al., 1998; Brandstädter, 1998; Lerner & Busch-Rossnagel, 1981), as stated above, is central to the concept of life composition. Still, some behaviors are more heavily influenced by the requirements of one’s developmental context than others. Obligatory personal life investment reflects the age-related biological, motivational, social, and cultural challenges that need to be met in order to acquire, maintain, or recover basic resources for developmental regulation. Here, the developmental context dictates where energy and effort *ought* to be invested. Optional personal life investment represents engagement in life domains that are not existential or compulsory but may contribute to a sense of self-actualization, meaning in life, and well-being. The person is relatively free to decide where he or she *likes* to invest.

This study has three main parts, addressing three major questions. The first part draws on cross-sectional BASE data and deals with the functional relations and validation of personal life investment. The assumption that PLI shows meaningful relations to other constructs relevant to life composition, such as personality dispositions, self-definitions and possible selves, and activities is tested. Is PLI linked to personal dispositions, self-defining goals, and actual activity engagement? The longitudinal BASE sample is employed in the second part of this dissertation, which deals with the development of average PLI, PLI selectivity, obligatory PLI, and optional PLI. How does PLI, and specifically investment in the “musts” and “cans” of aging, change with increasing age? Longitudinal trajectories are estimated and compared to the picture emerging from the cross-sectional data. In addition, the dynamic interplay between obligatory and optional PLI is explored. Issues of selectivity effects in the longitudinal sample, generalizability of the results, and differential intraindividual development receive special attention throughout this part. In the final part, the relationship between the four PLI facets (average PLI, PLI selectivity, obligatory PLI, optional PLI) and one aspect of successful aging, namely maintaining a stable sense of satisfaction with one’s life and one’s aging, is addressed. Here, the moderating role of PLI on the impact of deteriorating functional health on satisfaction is of special interest. Can PLI contribute to high levels of satisfaction despite losses in functional health? Do obligatory and optional PLI play a different role for successful aging?

In the following sections, the theoretical underpinnings of the study are described. First, the theoretical framework of life composition is introduced. The study of life composition requires an understanding of how different elements of the self-system interact in regulating one’s development and an understanding of how the self transacts with developmental influences that are external to the self. In short, we need a model of the dynamics within the person and a model of the dynamic interactions between the person and his or her developmental ecology. The model of the mechanics and pragmatics of life (Staudinger & Pasupathi, 2000) is employed
A Introduction

as a model of the person and the relational model of resilience (Staudinger & Greve, 2001; Staudinger et al., 1995) is used as a basic model of the person in context. In the final section of part B, the four PLI facets are introduced and described. Part C deals with the theoretical background relevant to the first major question of the study, namely, the relations between PLI and other elements of life composition. The physiological underpinnings (mechanics) of PLI and the role of PLI within the pragmatic self-system are discussed. Moreover, an approach to the validation of PLI is identified. Part D pertains to the second major research question of how PLI develops during old age. It focuses on the developmental context during old and very old age and its impact on life composition. Developmental changes in self-concepts, goals, and activities during old age serve as a basis to derive hypotheses on the late-life development of PLI. An excursus on general problems and challenges in longitudinal studies with old people is also included. The concept of successful aging and the hypothesized role of PLI for successful aging are discussed in Part E. This part provides the theoretical foundations for answering the third major research question. The relational model of plasticity introduced in part B is again considered as a framework for the study of how change in functional health status impacts on subjective well-being and of whether PLI can moderate this impact. Part F summarizes the goals and hypotheses of this study. The methods and results of the study are described in parts G and H. Finally, part I includes a summary and interpretation of the results. The functionality and development of PLI are discussed in relation to successful aging. Also, the question is asked whether interventions to enhance subjective well-being in older adults could be derived from the present findings.
B PERSONAL LIFE INVESTMENT AS ONE ELEMENT OF LIFE COMPOSITION

Life composition (Staudinger, 1999b) refers to the dynamic processes that operate when individuals attempt to master life in their actions and reactions. It entails processes of self- and developmental regulation and conscious and unconscious attempts at managing our lives. Throughout this dissertation, the term “self-regulation” is used in a general sense as systematic processes that involve setting (conscious and unconscious) goals and steering behavior toward goal attainment within a changing external environment (cf. Bockaerts, Pintrich, & Zeidner, 2000; Carver & Scheier, 1998). In addition to this active role of individuals in shaping their lives in interaction with life contexts, life composition also comprises processes of how individuals are themselves shaped by such contexts. It is important to note that life composition is not conceptualized as a person variable, that is, a trait-like ability. Rather, it denotes the activity of an integrally fused person-environment system. Similar to developmental systems theories (cf. Lerner, 2002), the concept of life composition depicts the individual as an active, purposeful part of an integrated, complex, and dynamic person-context system that involves multiple dimensions and levels of organization, such as the physiological, psychological, social, cultural, and historical level (e.g., Bronfenbrenner & Morris, 1998; Magnusson & Stattin, 1998; Thelen & Smith, 1998). As of today, we are not able to study life composition in all its complexity. Thus, it becomes necessary to select and study some aspects of the dynamic system of life composition that may provide a—necessarily incomplete—understanding of how individuals shape their lives in interaction with developmental contexts. Personal life investment is one such aspect of life composition. Life composition involves regulatory processes that steer one’s actions and thoughts in accordance with one’s goals. In this context, PLI assesses how people distribute their energies across central life domains while pursuing personal goals. PLI includes investment in life’s basic necessities or obligations and also investment in more individualized or optional strivings.

In order to study PLI as one element of life composition, it is useful to have theoretical models that help to identify and understand relevant aspects and parts of life composition. Magnusson and Stattin (1998) named two types of interaction processes that can be distinguished to investigate developmental systems: (a) continuously ongoing, reciprocal interactions among

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1 It should be noted that there is no generally agreed upon definition of self-regulation but rather different conceptions across different lines of research (Zeidner, Bockaerts, & Pintrich, 2000). Some authors attach a highly specific meaning to the term (e.g., Kuhl & Fuhrmann, 1998). In other cases, self-regulation is restricted to self-set goals or goals with internal origin (as opposed to originating in the external world). And sometimes self-regulation is conceived of as an aptitude or trait denoting the tendency or ability to self-regulate (cf. Zeidner et al, 2000). In temperament theories, the term self-regulation denotes processes that serve to regulate one’s attention and affective reactions (e.g., Rothbart & Bates, 1998). Here, self-regulation is not related to conscious personal goals but rather to more implicit goal representations.
mental, biological, and behavioral factors within the individual, that is, inner interactions, and (b) continuously ongoing, bidirectional interactions between the person and the environment, that is, outer interactions. In the following, the model of the mechanics and pragmatics of life (Staudinger & Pasupathi, 2000) will be introduced as a model of the inner interactions between the physiological bases of the self and the culture-dependent aspects of the self that have developed in interaction with one’s developmental context. The relational model of resilience (Staudinger & Greve, 2001; Staudinger et al., 1995) is extended to include all aspects of plasticity and serves as a general model of the interactions between a person and his or her context. Here, life composition can be viewed as an umbrella term that denotes the integration of those two models of inner and outer interactions. The functionality and development of personal life investment critically depends on its role within the entire system of life composition.

1 The Mechanics and Pragmatics of Life

Originating from the mechanic-pragmatic distinction in the study of cognitive development across the life span (e.g., P. B. Baltes, Dittmann-Kohli, & Dixon, 1984; P. B. Baltes et al., 1998), the dual-component model of the mechanics and pragmatics of life was formulated as an integrative and overarching theoretical framework for the study of psychological functioning in general (i.e., cognition as well as self and personality; Staudinger & Pasupathi, 2000; see also P. B. Baltes et al., 1998; Schindler & Staudinger, in press). Like other models of the systemic interaction between nature and nurture (e.g., Gottlieb, Wahlsten, & Lickliter, 1998; Thelen & Smith, 1998) the model draws attention to how both biology and culture shape human development. The biology-based, content-poor mechanics of life are distinguished from the culture-dependent, content-rich pragmatics of life. We can view the mechanics as the “hardware” that forms the basis for any kind of development, while the pragmatics represent the “software” that contains our acquired factual and procedural knowledge. Thus, physiological processes associated with encoding and processing of information, basic motivational tendencies (approach, avoidance), or basic emotional reactions (positive, negative) all belong to the mechanics of life. What we know about the world or ourselves and our regulatory functions and skills are instances of the pragmatics of life.

For the study of personal life investment, it is beneficial to focus on the part of the general dual-component model that is concerned with the mechanics and pragmatics most relevant to self and personality functioning (cf. Schindler & Staudinger, in press) or striving for personal goals, respectively. Figure 1 depicts the part of the model that is central to the present study. The constructs employed in this study have been included as illustrations. Note, however,
that any self and personality construct can be added to the model and studied within this framework (more constructs have been considered in Staudinger & Pasupathi, 2000). Within the pragmatics of self and personality, we can differentiate between more or less stable knowledge structures underlying self and personality and dynamic processes characterizing the functioning of self and personality (a distinction that is also made in other models of personality; e.g., Hooker, 2002; Hooker & McAdams, 2003; Mischel & Shoda, 1995, 1998). Knowledge about our self pertains to implicit knowledge about our self and to all aspects of the self-concept, for instance, trait conceptions of personality and the self-definition. Regulatory functions are the central processes in creating, maintaining, and restructuring self-knowledge, expressing our self, and pursuing self-relevant goals.

The mechanics and pragmatics (i.e., self-knowledge and self-regulation) of self and personality are a depiction of a multifaceted, multilevel, open, and dynamic self-system (cf. P. B. Baltes & Graf, 1996; Brandstädter, 1998; Ford, 1992; Herzog & Markus, 1999; Hull, 2002; Staudinger, 1999b). This self-system is defined as the self-concepts and self-referent processes that constitute the content and dynamics of a person’s behavior and personality (cf. Ford, 1992).

![Figure 1. The pragmatics of self and personality with central constructs of this study as illustration (adapted from Staudinger & Pasupathi, 2000).](image)

Personal life investment is part of the self-regulatory processes within the self-system. The model of a goal hierarchy is most frequently employed to study the working and organi-
zation of self-regulatory systems (cf. Carver & Scheier, 1998; Ford, 1992; Winell, 1987) and will subsequently serve as a basis to further discuss PLI. Within the framework of the goal hierarchy, PLI can be related and compared to other measures of the intensity of goal striving. However, we should not forget that our knowledge structures and also our basic life mechanics influence self-regulatory processes and are, in turn, influenced by self-regulatory processes (as illustrated by the double-headed arrows in Figure 1). For instance, knowledge about one’s self plays a central role in determining the content of personal goals and evaluating the outcomes of goal striving. Thus, the goal hierarchy does not suffice as a model to study all aspects of self-regulation. Consequently, the self-concept will also be considered as an important influence on self-regulation. But before I proceed with relating PLI to other self-system components, let me introduce a relational model of plasticity. This model draws attention to the necessity of considering developmental contexts and developmental influences in any study of developmental regulation. The subsequent distinction between obligatory PLI and optional PLI is based on this consideration of contexts.

2 A Relational Model of Plasticity

The impact of developmental challenges and demands on an individual’s future development can only be understood against the background of the resources that are available to her or him. These non-psychological (e.g., socioeconomic status, health status) and psychological resources (e.g., knowledge, openness to experience) constitute the individual’s reserve capacity. And this reserve capacity constitutes the degree of plasticity we can expect to see in a person (Staudinger et al., 1993, 1995). In lifespan psychology, plasticity denotes a person’s manifest, but also latent, change potential (as compared to the developmental or idiosyncratic “norm”) and how flexible and robust this person might be in dealing with developmental influences (e.g., P. B. Baltes, 1987; P. B. Baltes et al., 1998; Lerner, 2002; Staudinger et al., 1995). The concept of plasticity thus highlights the modifiability of development at any point in the life course. Whatever the current state of development may be, we have to consider that the individual might have developed differently in different circumstances and will have a certain degree of plasticity that allows for minor and sometimes even major developmental changes (see also Lerner, 2002). Still, it is important to note that these changes can be for better or for worse. Plasticity comprises any deviation from a developmental trajectory, that is, an increase in adaptive capacity, capacity maintenance despite challenges, and decline in adaptive capacity.

Here, I want to focus on positive forms of plasticity, that is, those that bring about an increase in level of adaptation or that allow one to maintain or regain a given level of adaptation
in spite of developmental loss or trauma. This latter form of plasticity is commonly referred to as resilience (e.g., Garmezy, 1991; Rutter, 1987; Staudinger et al., 1993, 1995). Taking a closer look at the construct of resilience reveals that there are three types of resilience (Staudinger & Greve, 2001; Staudinger et al., 1995): (a) maintenance of normal development despite non-psychological or psychological risks, (b) recovery from loss or trauma, and (c) management or regulation of irreversible losses. Whereas the first two types are commonly included in the resilience literature, the third type was identified and studied in the context of lifespan developmental psychology and, specifically, research on aging (cf. Staudinger & Greve, 2001). As aging brings about some irreversible losses, being able to accept these losses without falling into despair is an important aspect of resilience in old age.

It is important to highlight that resilience is not considered to be trait-like. Rather, the relational model of resilience (Staudinger & Greve, 2001; Staudinger et al., 1993, 1995) states that a person’s response to developmental challenges is a function of protective factors or resources that modify the person’s response and help in coping with the challenge. Those resources can lie within the person, and in some cases they are personality traits. But there are also external resources that are available or can be made available and can assist the individual in coping with external hazards. Resilience thus has to be considered as a relational construct that refers to a system of challenges and resources. A favorable balance of resources and challenges in the system is considered a resilient constellation and gives rise to resilient outcomes, such as preserved well-being or regained health or cognitive functioning.

As aging is associated with many irreversible losses and developmental challenges, it seems important to study processes that contribute to resilience. However, although many developmental influences during old age may contribute to more negative developmental trends it is important not to overlook the potential for positive influences on development even in old age (cf., P. B. Baltes et al., 1998; Kessler & Staudinger, in press). The original relational model of resilience (Staudinger & Greve, 2001) can easily be turned into a broader model of plasticity. To arrive at this relational model of plasticity (Figure 2) only some minor changes are needed: A general model of plasticity requires consideration of all kinds of influences that may alter the course of development, that is, opportunities in addition to risk factors (Kessler & Staudinger, in press). It also requires consideration of all kinds of developmental “outcomes,” that is, optimal development in addition to normal and pathological development (which are included in the resilience model). As a consequence, the relational model of plasticity can serve as a heuristic device to study all aspects of successful aging, that is, resilience, which is an integral part of successful aging (cf. Featherman, Smith, & Peterson, 1990; Rowe & Kahn, 1997), but also forms of plasticity that move beyond resilience. For instance, certain life circumstances and experiences
can bring about wisdom or exceptional levels of self-insight if they meet with the appropriate psychological and non-psychological resources (cf. Staudinger, 1999a; Staudinger, Dörner, & Mickler, in press). Please note that the inclusion of all forms of plasticity in one overarching model is not meant to suggest that the same processes that lead to resilience are also conducive to optimal development. Rather, as highlighted through the positive psychology movement (Aspinwall & Staudinger, 2003; Keyes & Haidt, 2003; Seligman & Csikszentmihalyi, 2000), positive development may not be governed by the same functional principles as negative development, and exceptional levels of functioning may not be explainable through processes that give rise to average levels of functioning. What the model is supposed to show is that the study of both resilience and growth requires the joint consideration of developmental influences and resources to explain a current state of development.

**Figure 2.** A relational model of plasticity with exemplary constructs (adapted from Staudinger & Greve, 2001). Constructs employed in this study are highlighted in bold.
The relational plasticity model (Figure 2) illustrates the complex interactions between positive and negative developmental influences and non-psychological and psychological resources and vulnerabilities in bringing about a current state of development. It should be stressed that not only resources but also vulnerabilities need to be considered as mediating or moderating factors on the impact of developmental influences. In many cases, vulnerabilities merely represent the negative end of a continuous, bipolar dimension that has a positive end representing a resource (cf. Masten, 2001). For instance, high intellectual ability is a resource while very low intellectual ability constitutes a vulnerability. However, there may also be pure resources or vulnerabilities.

In the model, a distinction between non-psychological versus psychological resources rather than external versus internal resources is drawn (Staudinger & Greve, 2001). Whenever we study an individual in relation to his or her developmental context, we have to draw a boundary between the individual and the context. Here, a distinction between person and environment with the dividing line of this contrast being the physical body of the person has been previously criticized (e.g., Deci & Ryan, 2000; Kleemeier, 1959; Murray, 1938; Ryan & Connell, 1989). A more useful distinction seems to be the one between the self and forces external to the self. The self is a phenomenal center of experience and agency that is not identical to the person’s physical being (e.g., Benson, 1987; Harré, 1984). In relation to this self, one’s body can be conceptualized as an environmental object or external resource or constraint that the self needs to react to and deal with (Kleemeier, 1959). Although an illness is localized in the same body as the perceiving and acting self, this self can feel constrained through illness and frailty and consequently start to act on the body to overcome disease and regain physical strength. Ryan and Connell (1989; see also Deci & Ryan, 2000) moved one step further in stating that “from the perspective of the self, forces within the person may be experienced as compelling or heteronomous, and thus would not be appropriately described as having an internal locus of causality, even when environmental pressures are clearly absent” (p. 750). Here, although taking place inside the person, the feeling that one should or must behave in a given way can have coercive influences on behavior that are perceived as stemming from external rather than internal sources. Cultural norms and values or the demands and wishes of significant others can therefore be conceptualized as external resources or constraints. Non-psychological resources or resources external to the self thus refer to developmental contexts that are objectively present, such as one’s objective health status, socioeconomic status, family and friends, or surrounding culture. Psychological resources or resources internal to the self pertain to subjective perceptions and evaluations of the objective developmental context, one’s self-concept and personality, or one’s cognitive functions.
In addition to the described elements of the relational model of plasticity, central constructs of the present study were highlighted in bold in Figure 2 to illustrate the analyses to follow. The placement of the constructs illustrates the aim of the present study to investigate PLI as a possible moderator of the impact of changes in functional health on life satisfaction and aging satisfaction. Here, it should be noted that indicators of subjective well-being are but one way to study plasticity in late-life development. In other studies other indicators may assume the central role.

In section E, I will discuss successful aging and the role of personal life investment in successful aging more fully. My main interest here was to introduce the relational model of plasticity (see also Kessler & Staudinger, in press). This model will serve as a framework for the study of how change and stability in functional health status relate to life satisfaction and aging satisfaction, and of whether PLI plays a role in moderating this relationship. Moreover, the model also illustrated a contextualistic view on human development and aging. In the following, the developmental context will again play an important role in differentiating PLI facets.

3 Four Facets of Personal Life Investment

Personal life investment has been introduced as one element of life composition. Specifically, PLI is defined as the amount of energy (in terms of action and thought) that people invest in striving for personal goals in various life domains. PLI is meant to reflect all energetic aspects of goal striving, that is, goal selection, planning, and goal pursuit, but also disengagement, worrying, and ruminative thoughts related to goals (cf. Staudinger & Schindler, 2005). In this study, four facets of personal life investment are differentiated. These facets will now be briefly introduced. The subsequent sections then provide a detailed discussion of the relations between the PLI facets and other elements of the self-system, the hypothesized developmental trajectories of the four facets, and the functional role of each facet in the process of successful aging.

Average PLI and PLI selectivity. The first two facets are global indicators of the amount and distribution of “psychological” energy (doing and thinking) across life domains. *Average PLI* (the average amount of investment across all life domains) is a measure of engagement with life overall or motivational intensity. *PLI selectivity* is conceptualized as the variability of investments across different life domains. High PLI selectivity indicates an uneven share of energy investment among life domains: The person focuses investment on a few domains while saving energy and effort in other life domains. In this context, we need to take into account different levels of selectivity. Selection can occur at any level within a goal hierarchy. Selectivity is always present on
the level of specific actions: Among a large number of possible ways to perform an action, only
one is finally chosen. A person’s goals also represent merely a small selection of possible goals.
PLI selectivity, in contrast, reflects selectivity on the level of life domains. As all PLI domains are
central life domains, this kind of selection most likely occurs only under severe resource
limitations, as they are often encountered in old and very old age.

Obligatory PLI and optional PLI. As the overall amount of PLI is a very general indicator,
two more PLI facets have been identified. Average PLI is split into obligatory PLI and optional
PLI to highlight the impact of developmental contexts on goal striving. There are things humans
must do (obligatory) and things humans can do (optional). Obligatory and optional strivings are
defined along the lines of the “musts” and “cans” inherent in human development. But how can
these “musts” and “cans” of development be conceptualized?

In lifespan psychology, development is defined as “systematic changes in the organization
of an organism, an organism seen as a functional, adaptively-oriented, open system throughout its
life span” (Lerner, 1978, p. 10; cf. P. B. Baltes, 1987; P. B. Baltes et al., 1998; Lerner, 2002). From
this perspective, personal goals aim at systematic changes in the adaptive capacity of an
individual, such as enhancing, maintaining, or regaining capacity or managing unrecoverable
losses in capacity. Some goals and activities thereby serve to create and protect a basis for
development. This basis can be defined as the prevention of loss in adaptive capacity/resources
and the maintenance of a basic motivation to strive for developmental gain (see P. B. Baltes &
can hence be captured by the term “self-maintenance.” Because humans, in contrast to animals,
are self-conscious organizers and creators of their development, which is embedded in a
sociocultural context, self-maintenance involves more than the protection of mere existence (cf.
Jaspers, 1988; Nuttin, 1984; Rentsch, 1994). It comprises biological, motivational, social, and
cultural components. Humans strive to protect their physical integrity, health, and security and to
ensure the survival of their genome in their offspring (biological maintenance). They also need to
protect a sense of independence and self-determination, or a basic motivation to influence the
world in accordance with their preferences (motivational maintenance; see Deci & Ryan, 2000;
J. Heckhausen, 1999). As humans are essentially social beings, they depend on, and hence need to
establish and maintain, a basic social network and some provision of culture (social maintenance).
Moreover, being aware of the finitude of one’s existence is a central motivator to transcend the
individual self (Jaspers, 1988; see also Erikson, 1959; Peck, 1956) and rather maintain this self as
embedded in and contributing to society at large or the common good (cultural maintenance).
Now, it is evident that the four aspects of self-maintenance are not equally prominent during all
phases of the life span. Rather, the specific opportunity structures and developmental contexts
during each phase of life render some aspects of self-maintenance more important and others less so. We can thus identify age-normative challenges to self-maintenance, which need to be mastered in order to avoid losses in adaptive capacity and enable normal or even successful development.

_Obligatory PLI_ can now be defined as investment in life domains that pose age-normative challenges to self-maintenance. That is, two criteria are central to determine which life domains are obligatory at a certain age: (a) the domain comprises some challenges or demands that need to be responded to and dealt with whenever they arise, and (b) for the majority of individuals the domain-specific challenges arise at this age. In this context, the individual cannot afford not to invest if he or she wants to avoid below average levels of functioning and maintain a basis for development. Obligatory life domains often do not offer much of a choice regarding where and when to invest. Still, meeting the basic requirements of life does not yet count as highly successful. Obligatory PLI is necessary but not sufficient for successful development.

The life domains that can be considered as obligatory clearly change across the life span: Throughout adulthood, family, independence, and thinking about one’s life are the only life domains that do not change their status as obligatory domains. One’s family, as the basic social network, is essential to social maintenance. Independence can be conceptualized as basic to motivational maintenance, as it involves a sense of autonomy or self-determination (cf. Deci & Ryan, 2000). Thinking about one’s life or life reflection is a basic tool for life composition (Staudinger, 2001), and hence motivational maintenance. Gaining insight into our life, integrating the past, present, and future, or monitoring and orchestrating processes of developmental regulation are essential if we want to find out what we want to achieve and how we can achieve it. As maintaining one’s physical and cognitive functioning (aspects of biological maintenance), generativity, and coming to terms with one’s life as lived (aspects of cultural maintenance; cf. Erikson, 1959; Erikson, Erikson, & Kivnick, 1986) gain in importance with increasing age, the associated life domains of health, cognitive fitness, and one’s death and dying become obligatory. Simultaneously, the domain of sexuality loses its obligatory status once biological reproduction is not possible (women) or not normatively expected (men) any more. One’s occupation ceases to be obligatory after retirement, when people do not need to work in order to earn a living (at least in present-day Germany).

Obviously, not every single goal that is pursued in an obligatory life domain aims at maintaining average levels of functioning. People usually strive to move beyond mere maintenance or provision of a basis for development. This points to the more complex or mixed nature of investment in obligatory domains. Part of this investment is absolutely necessary or a must, but there are also ample possibilities to invest beyond what is necessary and to achieve high
levels of growth or success within obligatory domains. Consider, for instance, the middle-aged woman who has made an impressive career or the old man who is in exceptionally good health. The question remains whether investing in obligatory domains could ever be necessary and sufficient for successful development in general, that is, across all areas of life. Is it enough to fulfill all the duties, obligations, and essential necessities in life and even move beyond what is necessary in obligatory domains, or is there something more that is needed for successful development?

Maslow (1943) stated that “what a man can be, he must be” (p. 382). This need for self-actualization is expressed after the more basic physiological needs and needs for safety, love, and esteem are satisfied. Probably, self-fulfillment cannot be attained solely within obligatory domains. With age-normative developmental goals not only is the content of possible goals constrained but the number of possible ways to pursue those goals is also limited. This means that obligatory investment can be associated with constraints on self-expression and, hence, self-actualization. It has been shown, for instance, that the achievement, physical comfort, affiliation, power, and “higher” motives of young to middle-aged adults are more easily satisfied in the (optional) leisure domain as compared with the (obligatory) work domain (Brandstätter, 1989). However, personal life investment cannot be reduced to obligatory investment; there is optional investment in addition.

Optional PLI comprises all kinds of energy and effort put into life domains that do not pose age-normative challenges to self-maintenance, but that are rather chosen on the basis of personal preferences, interests, skills, dispositions, or opportunities. Optional PLI is an important contribution to moving toward successful development. Its function is to optimize one’s current affective balance and also to attain future developmental gains. Compared to obligatory PLI, it allows for more choice as to whether, where, and how to invest in relevant life domains.

Usually, a person does not invest all available resources in pursuing goals in obligatory domains. The remaining resources can be invested in optional life domains that allow for more self-fulfillment or self-expression. Optional PLI can hence be considered as what we do with our free time and free resources. Consequently, the life domains of leisure and friends are the domains that remain optional throughout adulthood. As already mentioned, sexuality and work become optional during old age. It should be noted, however, that a classification of entire life domains as obligatory or optional can only be a rough distinction. As already mentioned, if one considers specific personal goals it is possible that more optional goals occur in life domains classified as obligatory. Similarly, personal goals that aim at avoiding below average levels of functioning (obligatory goals) may occur in life domains classified as optional.
The relationship between obligatory and optional PLI. Resources that can be invested in a person’s goal striving need to be distributed between obligatory and optional life domains. Here, obligatory PLI and optional PLI may show complex interrelations on the individual level. As a general rule of thumb, we can assume a primacy of obligatory PLI over optional PLI. Obligatory investment as a necessary basis for development requires a certain amount of resources. If those resources were invested in optional tasks and goals at the expense of obligatory goals this investment would not spur and maybe even threaten normal development. Under conditions of severe resource limitations, as they are often experienced during old and very old age, it is functional to first withdraw resources from optional rather than obligatory life domains. When resources are sufficient, however, investment in optional domains can help to spur successful development and increase life satisfaction as it allows for more self-actualization and the expression of personal preferences.

The general rule that obligations need to be met before one can turn to options is assumed to hold for most individuals. Nevertheless, development is a highly complex process and there are always exceptions to the rule. For instance, there are situations when optional investments actually serve to compensate for shortcomings in obligatory investments. Some individuals lack age-typical opportunity structures in a specific life domain and thus may experience limitations to fulfilling self-maintenance needs via obligatory investments. That is, they cannot meet obligations in the “usual” way, no matter how hard they may try. In these circumstances, compensatory activities can help to achieve self-maintenance via investment in other obligatory or optional life domains. Thus, besides providing opportunities for self-actualization, classic “optional” investments may serve to compensate for limited opportunities for obligatory investments. Optional PLI may help to occupy one’s time but also provide alternative means for self-maintenance. For instance, lonely people, that is, those who experience deficits in social maintenance, can benefit from engaging in leisure activities (cf. Elbing, 1991). People who do not have any living nuclear family members may turn to friends for the provision of a basic social network, companionship, and satisfaction of needs for emotional closeness (e.g., Lang, Staudinger, & Carstensen, 1998; Pinquart, 2003).

From the above description, it should have become evident that the four PLI facets have different self-regulatory antecedents and consequences, can be expected to show different developmental trajectories, and may serve different functions for development. A detailed discussion of these issues will be provided subsequently. The next chapter will consider PLI as related to other elements of life composition; chapter D deals with the late-life development of PLI; and chapter E discusses PLI in relation to successful aging.
C RELATIONS BETWEEN PERSONAL LIFE INVESTMENT AND OTHER ELEMENTS OF LIFE COMPOSITION

Life composition denotes the transactions between a self-system and its developmental context. The self-system thereby comprises the mechanics and pragmatics of self and personality. However, the self-system is rarely studied in its entirety. In spite of an increasing interest in linking the underlying processes and structures of self and personality (e.g., Carver, Sutton, & Scheier, 2000; Hooker & McAdams, 2003; Markus & Wurf, 1987; Mischel & Shoda, 1998; Staudinger & Pasupathi, 2000), much research is still focused on specific aspects of the self-system, such as the physiological bases of the system (life mechanics), the personal goal hierarchy, actions and thoughts, or the self-concept.

The first major aim of this study is to relate PLI, as one element of the self-system, to other elements of the self-system, namely personality dispositions, self-definitions, possible selves, and activities. The demonstration of linkages between PLI and those other elements can add to the validation of the PLI construct. For this purpose, conceptualizations of different aspects of the self-system are introduced. Specifically, some mechanic bases of the self-system, and hence life composition, are identified. Subsequently, the concept of a personal goal hierarchy and the constructs of actions and thoughts will help to learn more about self-regulatory functions (of which PLI is a part). As it is also necessary to consider self-knowledge structures in addition to self-regulatory functions (cf. Figure 1, p. 7), the self-concept is further discussed. Although the life mechanics, the goal hierarchy, actions and thoughts, and the self-concept are all incorporated in one self-system and hence necessarily overlap, each conceptualization helps to illustrate different functional relations of PLI. It should become evident how PLI, personality dispositions, self-definitions, possible selves, and activities are conceptualized and how they relate to each other. Once this has been accomplished, self-regulatory antecedents and consequences of obligatory PLI and optional PLI are illustrated to gain a better understanding of the “working” of these two PLI facets. In a final section, similarities and differences between PLI and the introduced elements of the self-system are summarized and a first set of hypotheses regarding the validation of PLI is derived.

1 Mechanic Bases of the Self-System

Like any other element of the self-system, self-regulatory processes depend on and are to a certain limited extent constrained by the mechanics of life (Schindler & Staudinger, in press), which are the physiological basis for any kind of behavior. Individual differences in the general
level of activation or global activation patterns are assumed to be reflected in self-regulatory behaviors and, more specifically, PLI as a measure of motivational intensity. This section deals with some life-mechanic aspects that are relevant to self-regulation.

**Activity level and arousability.** Activity level is a central concept in nearly every temperament theory (cf. R. P. Martin, Wisenbaker, & Huttunen, 1994), hence one of the biologically based cores of personality. It is commonly defined as an “individual’s customary level of energy expenditure through movement” (Eaton & Enns, 1986, p. 19) and often measured via questionnaire or in terms of spontaneous gross motor activity (cf. R. P. Martin et al., 1994). Further, activity level has been conceptualized as contributing to extraversion or surgency (e.g., Hagekull, 1994; Rothbart, Ahadi, Hershey, & Fisher, 2001).

In addition to individual differences in the spontaneous production of motor activity, individuals differ in their sensitivity to stimulation or preference for high or low levels of arousal (e.g., Aron & Aron, 1997; Eysenck, 1981; R. P. Martin et al., 1994; Mehrabian, 1991; Thomas & Chess, 1977). Highly arousable people prefer environments that involve lower levels of stimulation compared with less arousable people. The behavioral patterns of extraverts and introverts have been linked to those interindividual differences in arousability or sensitivity (e.g., Aron & Aron, 1997; Eysenck, 1981, 1987). Extraverts can be characterized as less sensitive to stimulation and thus preferring social, exciting, or novel situations, while introverts seek more privacy, quiescence, or routine.

Now, what has this got to do with personal life investment? Both activity level and arousability can be related to average PLI. Apart from the domain-specific content of personal life investment, we can conceive of average PLI as influenced by individual differences in activity level or “a general activity or g factor in the act domain” (D. M. Buss & Craik, 1983, p. 115). In line with the assertion of A. H. Buss and Plomin (1975) that “other things being equal, active persons do more of everything” (p. 121) it can be concluded that the amount of self-reported investment in goal pursuit may be higher in individuals with a biological predisposition toward high activity levels. Low arousability may also be conducive to high average PLI. As active goal-pursuit involves certain levels of stimulation and often takes place in a social context, highly sensitive people might have to limit engagement with their environment to avoid overstimulation (cf. Aron & Aron, 1997).

Extraversion is the trait that has been linked to both high activity level and low arousability. We can thus assume that extraversion and average PLI have a common basis in the mechanic aspects of self and personality. If a biological predisposition toward high activity level and low sensitivity to stimulation is conducive to both high average PLI and high extraversion, we can expect some correlation between PLI and extraversion. And indeed, this positive relation
between extraversion and average PLI has been demonstrated in a sample with participants ranging in age between 14 and 103 years (Staudinger & Schindler, 2005).

Nevertheless, those global attempts at describing personality functioning can be criticized as too unspecific and overarching. For instance, there is no generalized physiological arousal and different physiological measures of arousal (e.g., heart rate, EEG, or skin conductance) tend to produce only modest intercorrelations (cf. Eysenck, 1987; Zuckerman, 1987). Furthermore, assessments of activity level in infants are equivocal in predicting subsequent personality. Some manifestations of activity level are associated with intense negative emotional expression in infants. This kind of activity is predictive of neuroticism rather than extraversion (R. P. Martin et al., 1994). That is, activity level is not only a precursor of extraversion but can also be related to neuroticism.

The behavioral approach and inhibition systems. Today, many physiological models of self and personality differentiate two systems that are related to the more “positive” or more “negative” aspects of activation and behavior (cf. Carver et al., 2000). In searching for the neurobiological bases of personality, evidence accumulated showing that behavior can be differentiated into approach and avoidance tendencies with different underlying neurobiological systems (e.g., Davidson, Jackson, & Kalin, 2000; Depue & Lenzenweger, 2001; Kosslyn et al., 2002; see also W. Heller, Schmidtke, Nitschke, Koven, & Miller, 2002). One system, the approach system, deals with appetitive motivation and approach behavior and generates particular types of positive affect associated with positive incentive motivation (Depue & Collins, 1999; Gray, 1981). The other system, the inhibition or withdrawal system, deals with aversive motivation, withdrawal or avoidance behavior and involves negative affective states that are withdrawal-related, e.g., anxiety and disgust (Davidson, 1998; Depue & Lenzenweger, 2001; Gray, 1981). The approach and inhibition systems have been extensively studied (some of the evidence is synthesized in Carver et al., 2000; Davidson et al., 2000; Kosslyn et al., 2002; see also Keltner, Gruenfeld, & Anderson, 2003).

The prefrontal cortex has been found to reflect the activation of the approach and inhibition systems, with relative increases in left-sided prefrontal activation indicating the activity of the approach system and relative increases in right-sided prefrontal activation indicating the activity of the withdrawal system (cf. Davidson et al., 2000; Kosslyn et al., 2002). On the neuroendocrine level, dopamine has been considered as important for the functioning of the approach system and norepinephrine as important for the functioning of the inhibition system (Depue & Collins, 1999; Depue & Lenzenweger, 2001). Positive and negative affect have also been linked to the activation of the approach and inhibition systems. However, it is important to note that not all kinds of positive affect relate to the approach system and not all kinds of
negative affect relate to the inhibition system. For instance, only pre-goal attainment positive emotions like enthusiasm or eagerness, but not post-goal attainment positive emotions like contentment have been associated with the approach system (Davidson, 1998; Depue & Collins, 1999).

What is important to the present study is that the approach and inhibition systems are not only linked to the regulation of behavior, affect, and cognition, but also help to explain (relatively stable) interindividual differences. The terms “approach temperament” and “avoidance temperament” (Elliot & Thrash, 2002) have been coined to differentiate two biologically-based broad dimensions of personality. A lot of empirical evidence has demonstrated that the personality dispositions of positive affectivity, extraversion, and strength of the behavioral activation system (BAS strength as measured by the BIS/BAS Scales; Carver & White, 1994) are indicative of an approach temperament and that the personality dispositions of negative affectivity, neuroticism, and strength of the behavioral inhibition system (BIS strength) are indicative of an avoidance temperament. For instance, associations between the approach-related and avoidance-related personality dispositions and physiological indicators of the approach and inhibition systems have been demonstrated (for overviews see Davidson et al., 2000; Kosslyn et al., 2002). Dispositional positive and negative affect as measured by the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) were shown to correlate with cerebral activation asymmetries. Participants characterized by relative left hemisphere activation in mid-frontal and anterior temporal regions reported more positive affect and less negative affect when compared with participants characterized by relative right hemisphere activation (Tomarken, Davidson, Wheeler, & Doss, 1992). Similar results were obtained for extraversion and neuroticism. Extraversion (as measured with the NEO-PI-R; Costa & McCrae, 1992) was associated with greater relative left frontal activity and neuroticism was associated with greater relative right frontal activity (W. Heller et al., 2002). Finally, this pattern of findings was also demonstrated with the BIS/BAS Scales (Carver & White, 1994): Individuals with tonically more active left prefrontal regions reported greater BAS strength compared with individuals with tonically more active right prefrontal regions, who reported greater BIS strength (Sutton & Davidson, 1997).

Moreover, intercorrelations of self-report measures of extraversion, neuroticism, positive and negative affect, and BAS and BIS also support a common neurobiological substrate of these traits. BAS strength demonstrated positive relations with extraversion and positive affectivity, while BIS strength was positively correlated with anxiety and negative affectivity (Carver & White, 1994). Positive affectivity has been associated with extraversion and negative affectivity has been associated with neuroticism (e.g., Costa, McCrae, & Norris, 1981; Larsen & Ketelaar, 1991; Tellegen et al., 1988; Watson & Clark, 1997; Watson, Wiese, Vaidya, & Tellegen, 1999).
Factor analyses of measures of extraversion, positive emotionality, BAS strength, neuroticism, negative emotionality, and BIS strength yielded a two-factor structure representing approach temperament and avoidance temperament (Elliot & Thrash, 2002). Here, it needs to be emphasized that approach and avoidance temperaments do not represent the two ends of one dimension but rather two separate dimensions. A person can show any combination of values on the two dimensions, for instance, high on approach and high on avoidance or low on approach and low on avoidance.

Approach and avoidance temperaments will again become important when the functional properties of obligatory and optional PLI are discussed. But first, let me introduce the personal goal hierarchy. The goal hierarchy is probably most interesting to the study of PLI as PLI can be conceptualized as goal dimension or goal cognition (e.g., Karoly, 1993).

2 The Personal Goal Hierarchy

According to Charlotte Bühler, the “study of goals of life is an essential part of the study of the human course of life as a whole” (Bühler, 1961, p. 8), or, we may add, an essential part of the study of the pragmatic self-system. At the most basic level, goals can be defined as “internal representations of desired states, where states are broadly construed as outcomes, events, or processes” (Austin & Vancouver, 1996, p. 338; see also Carver & Scheier, 1998). Goals, and also the entire goal hierarchy as an organization of the totality of goals, evolve from person-environment interactions. The development of a goal hierarchy begins with the basic biological needs and preferences of the infant. In acting upon and reacting to material and information in the environment, personal goals develop and change. Like any other kind of development, the development of a personal goal hierarchy can be described by the “orthogenetic principle which states that wherever development occurs it proceeds from a state of relative globality and lack of differentiation to a state of increasing differentiation, articulation, and hierarchic integration” (Werner, 1957, p. 126). The material, social, and cultural context, the individual’s biological make-up (i.e., the life mechanics), and the proactive role of the individual in shaping her or his development are all important factors that influence this development of a goal hierarchy. Thus, as asserted by Freud (e.g., 1941/1999), goals may arise from biological impulses and the unconscious interplay of the psychic forces those impulses activate. Current research has found that goals do not need to be conscious to determine a substantial part of a person’s everyday life. Some mental processes are put into motion by features of the environment and operate outside of conscious awareness and guidance. Those processes are instances of automatic goal pursuit (Bargh, 1990; Bargh & Chartrand, 1999). But goals also result from conscious choices and life
planning (e.g., Smith, 1996, 1999). This means that we cannot consciously access all goals that are part of our goal hierarchy and do not possess complete insight about all motivating forces behind our behavior. Nevertheless, people are conscious about a large part of their goals and can report on those consciously held personal goals. People also have no trouble with thinking about their goals in terms of a hierarchy. They can easily create cognitive representations of goal hierarchies and are able to move up and down between different hierarchical levels if asked to create “by” relations (Vallacher & Wegner, 1987) or “how” and “why” they pursue certain goals (B. R. Little, 1989; Powers, 1973; see also Cantor & Langston, 1989). Those representations of goals and related actions typically do not involve low-level concepts like motor goals or high-level concepts like overarching motives, dispositions, or terminal values (cf. Carver & Scheier, 1998; Vallacher & Wegner, 1987; Wadsworth & Ford, 1983). Still, some influences of unconscious motives or goals involved in automatic goal pursuit may be detectable in those personal accounts of goals.

Personal life investment taps into everyday conceptions individuals have about their actions and goals. It can thus be related to a large number of studies on people’s self-reported personal goals, strivings, concerns, tasks, or future selves. Specifically, PLI assesses the amount of energy that is expended during the selection and pursuit of goals and hence can be compared to other goal dimensions that assess the energetic aspect of goal-related behavior. However, in contrast to many other goal dimensions, PLI is not measured for specific personal goals but rather for entire life domains that contain a wealth of different goals at all levels of the goal hierarchy. Both the specific action of preparing breakfast for one’s spouse and the abstract goal of wanting to be a good grandmother can give rise to a high PLI rating in the family domain. PLI across different life domains is thus orthogonal to the levels of a personal goal hierarchy. Winell’s (1987) conception of a goal hierarchy as a pyramid made up of specific life domain “cones” is helpful in illustrating the relation between PLI and the goal hierarchy. As depicted in Figure 3, the PLI domains span the entire goal hierarchy. It is important to note that the individual cones of the pyramid are overlapping, that is, a specific goal can belong to more than one life domain. For instance, going to the playground with one’s grandchildren is related to the family domain, but may also be related to the health domain as it involves being physically active. Thus, Figure 3 merely depicts a heuristic model of a personal goal hierarchy. There are many more domains that are relevant to an individual and the connections and interactions between different goals and life domains are much more complex.

The model of a goal hierarchy presented illustrates two ways in which goals can be “localized” in the hierarchy. If we focus on what the person wants and how this aim is related to other lower-level and higher-level goals, we depict the goal on a specific level in the hierarchy, that is, we think about the hierarchy in vertical terms (cf. the comparison of abstract vs. concrete
goals, e.g., Emmons, 1992). But if we are interested in the life domains that currently receive most attention and energy investment, we try to identify the life domain or domains this goal is relevant to, that is, we think about the hierarchy in horizontal terms. This kind of approach is taken when we assess personal life investment. In reporting on PLI, people are not required to identify a specific level in the goal hierarchy that they should think about. We know that effective behavior is simultaneously represented at low and high levels in the goal hierarchy (cf. Bandura, 1996; Ford, 1992; Freund & Baltes, 2000; Vallacher & Wegner, 1987; Winell, 1987). High-level goals are important for providing a long-range vision and giving meaning to one’s life. As those high-level goals are too abstract to derive strategies that get one there or explicit criteria for success, proximal subgoals on lower levels are needed. The current level of goal identification always involves a trade-off between manageable and meaningful goals (B. R. Little, 1989). According to action identification theory (Vallacher & Wegner, 1987) goals will be identified on the highest possible level of abstraction unless difficulties arise that necessitate a lower level identification. Finding that an action plan is disrupted or does not work out, people start to concern themselves with the how-to aspects of action until the problem is solved. In any case, no matter on which level the goal is typically or currently represented, asking about personal life investment allows reporting actions and thoughts pertaining to all levels of identification within a specific life domain.

Figure 3. Schema of a personal goal hierarchy with selected PLI domains (adapted from Winell, 1987).
The next sections are concerned with personal goal constructs or personal action constructs (PACs, B. R. Little, 1989) and the goal content domains and goal dimensions that have been employed to study goals. PLI is introduced as one goal dimension and related to other goal dimensions.

a. **Goal Constructs and Goal Dimensions**

Although there has been and still is much debate as to whether human conduct can be categorized into a finite number of universal end goals and which goals those would be (e.g., Bakan, 1966; Bühler, 1965; Deci & Ryan, 2000; Epstein, 2003; Erikson, 1959; Hogan & Roberts, 2000; Lersch, 1970; Maslow, 1943; McDougall, 1921; Murray, 1938; Reiss & Havercamp, 1998; Rokeach, 1979; Steverink, Lindenberg, & Ormel, 1998), there is no doubt that individuals differ widely as to their specification of those high-level end goals at lower levels of the goal hierarchy. To account for this diversity, an idiothetic approach (a mixture between the idiographic and nomothetic approach; cf. Lamiell, 1981) to the investigation of personal goals has been taken. Goals were often studied by asking people to write down their concerns, strivings, or goals (idiographic approach), and subsequently rate these idiosyncratic goals on a number of specified goal dimensions (nomothetic approach). For further comparison, the individual goals were also often categorized into specific goal content domains. This approach has the disadvantage of being quite time consuming, especially if the idiosyncratic goals are to be categorized afterwards into specific life domains by trained coders. Thus, an alternative and more timesaving approach has been to provide participants with a list of selected life domains or goals. Those lists have often been inspired by proposed end goals of human motivation. For instance, Rokeach’s (e.g., 1979) terminal values have been employed as a starting point for the identification of goal domains (Brandtstädter & Baltes-Götz, 1990; Roberts & Robins, 2000), or studies were based on Bühler’s (e.g., Bühler, 1965; Bühler, Brind, & Horner, 1968) work on life goals (Rapkin & Fischer, 1992a, b).

Although approaches to the study of personal goals differ in their consideration of idiosyncratic goals, they mostly share two central features. First, goals are categorized into different goal domains (e.g., family, work, health). Second—and this is why personal goals are central to the study of PLI—the self-generated or provided goals are rated along several goal dimensions (e.g., importance, difficulty, control). Personal life investment is one of these goal dimensions or goal cognitions (cf. Karoly, 1993), which captures the degree to which a person is subjectively engaged in pursuing goals in a specific life domain or the intensity of goal-oriented behavior (cf. Hyland, 1988). Six factors have been identified across several empirical and theoretical approaches to the dimensionality of goal appraisals (Austin & Vancouver, 1996):
importance-commitment, difficulty-level, specificity-representation, temporal range, level of consciousness, and connectedness-complexity. Although not considered by Austin and Vancouver (1996), personal life investment can be included in the importance-commitment factor that comprises such dimensions as goal attractiveness, intensity, valence, importance, degree of energization, or commitment.

In the following, the accumulated evidence on goal investment, energization, or absorption and goal importance will be summarized. For this purpose, approaches to personal goals have been identified that included at least one goal dimension belonging to the importance-commitment factor. Table 1 provides an overview of relevant goal concepts, including idiothetic as well as nomothetic approaches. Some interesting research on personal goals (e.g., Dittmann-Kohli, 1995; J. Heckhausen, 1997; Lapierre, Bouffard, & Bastin, 1993; Nuttin & Lens, 1985) was not included here, as it did not address dimensions relevant to importance, commitment, or investment. This research will be considered in subsequent chapters.

**Idiothetic goal concepts.** The different idiothetic goal concepts in Table 1 will be briefly mentioned here as excellent overviews of these constructs already exist (Austin & Vancouver, 1996; Brunstein & Maier, 1996; Emmons, 1997; Gollwitzer & Bargh, 1996; Pervin, 1989). All personal goals are reference values for behavior, discrepancies from which initiate and organize action (cf. Carver & Scheier, 1998). Current concerns (Klinger, 1975, 1977), personal projects (B. R. Little, 1983, 1989; Palys & Little, 1983), life tasks (Cantor, 1990, 1994; Cantor & Kihlstrom, 1985; Cantor & Langston, 1989), personal goals (Winell, 1987; Wadsworth [Winell] & Ford, 1983), personal strivings (Emmons, 1986, 1989), possible selves (Markus & Nurius, 1986; Markus & Ruvolo, 1989; see also Hooker, 1999), and other idiographic goal concepts (Brunstein, 1993, 1999; Lecci, Okun, & Karoly, 1994; Nurmi, 1992) all aim at an assessment of the central goals a person currently holds and pursues. However, the goal concepts also differ from each other in some respects. These differences can be discussed, for instance, along the dimensions of level of abstractness (concrete vs. abstract), stability (short-term goals vs. long-term goals), and relevance of sociocultural contexts (cf. Brunstein & Maier, 1996; Emmons, 1997). The goals studied in a framework of current concerns or personal projects are usually more concrete and short-lived compared to the goals studied under the heading of life tasks, personal strivings, or possible selves. The life tasks and personal projects perspectives pay special attention to the influence of sociocultural contexts on the formation and pursuit of personal goals (e.g., B. R. Little, 1999; Cantor & Fleeson, 1991), whereas those factors are of smaller relevance to the other approaches.
### Table 1
Overview of Idiothetic and Nomothetic Approaches to the Study of Personal Goals

<table>
<thead>
<tr>
<th>Approach</th>
<th>Idiothetic</th>
<th>Selected references</th>
<th>Life tasks</th>
<th>Personal goals (measurement instrument)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal concept (measurement instrument)</td>
<td>Current concerns (Concern Dimensions Questionnaire)</td>
<td>Personal projects (Personal Projects Analysis Kit)</td>
<td></td>
<td>(Personal Goal Inventory)</td>
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<tr>
<td></td>
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<td>Klinger (1977); Klinger et al. (1980)</td>
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<tr>
<td>Goal dimensions</td>
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<tr>
<td>-Commitment</td>
<td>-Absorption: “To what extent you become engrossed or deeply involved in a project.”</td>
<td>Dimensions after Little (1983): -Absorption -Importance -Enjoyment</td>
<td>-Investment: “To what extent will you invest time, effort, money, and/or materials into achieving these goals?”</td>
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<td>-Loss</td>
<td></td>
<td>-Difficulty -Control</td>
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<td>-Positivity</td>
<td></td>
<td>-Initiation -Stress</td>
<td>-Activity: “How actively involved are you with pursuing these goals right now?”</td>
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<td>-Negativity</td>
<td>-Importance</td>
<td>-Time spent -Others’ view</td>
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<tr>
<td>-Instrumentality</td>
<td>-Difficulty</td>
<td>-Progress</td>
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<td>-Probability of success</td>
<td>-Importance</td>
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<tr>
<td>-Confidence in estimate of probability</td>
<td>-Importance</td>
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<tr>
<td>-Nearness</td>
<td>-Difficulty</td>
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<tr>
<td>-Time available</td>
<td>-Importance</td>
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<tr>
<td>-Causal attribution</td>
<td>-Absorption</td>
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<tr>
<td>-Sense of drain</td>
<td>-Absorption</td>
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<tr>
<td>Goal dimension factors</td>
<td>4 Factors: -Intensity of valence -Direction of valence -Probability of success -Imminence</td>
<td>3 Factors (Rathbun): -Project mastery -Project strain -Self-involvement</td>
<td>3 Factors (T1): -Anxiety-absorption -Personal responsibility -Rewardingness</td>
<td>4 Factors: -Value -Expectancy -Clarity</td>
</tr>
<tr>
<td></td>
<td>5 Factors (McGregor): -Integrity -Efficacy -Self-benefit -Fun -Support</td>
<td>-Importance-absorption</td>
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<td></td>
<td></td>
<td>-Stressfulness</td>
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<td></td>
<td></td>
<td>-Reward-control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal domains</td>
<td>No categorization</td>
<td>-Academic -Interpersonal -Intrapersonal -Recreational/hobbies -Cultural -Gifts/holidays -Travel -Environmental adaptation -Vocational -Home activities -Spiritual -Health/body</td>
<td>-3 Achievement (doing well academically, establishing future goals, managing time)</td>
<td>-Work and school (family life, social life, personal growth and maintenance, leisure, material/environmental, other/general)</td>
</tr>
</tbody>
</table>

*The first entry represents the dimension closest in meaning to PLL.
*The first factor is the one on which the dimension closest in meaning to PLI obtained the highest factor loading.
### Table 1 continued

<table>
<thead>
<tr>
<th>Approach</th>
<th>Idiothetic</th>
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<tbody>
<tr>
<td><strong>Goal concept</strong> (measurement instrument)</td>
<td><strong>Personal strivings</strong> (Striving Assessment Scales)</td>
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<tr>
<td><strong>Goal dimensions</strong></td>
<td>-Effort: “How much energy and effort do you generally expend in trying to be successful in the striving?” -Importance -Commitment -Value -Ambivalence -Difficulty -Causal attribution -Social desirability -Clarity -Instrumentality -Probability of success -Confidence -Probability if no action -Impact -Goal conflict</td>
</tr>
<tr>
<td><strong>Goal dimension factors</strong></td>
<td>5 Factors: -Ease -Degree of striving -Success -Desirability -Instrumentality</td>
</tr>
</tbody>
</table>

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The first entry represents the dimension closest in meaning to PLI.

The first factor is the one on which the dimension closest in meaning to PLI obtained the highest factor loading.
<table>
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<th>Approach</th>
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<tr>
<td>Goal dimensions*</td>
<td><strong>Investment:</strong> How much time, energy, or thought was invested in the goal or regret.</td>
<td><strong>Effort:</strong> “Even if it means a lot of effort, I will try everything necessary to accomplish this goal.”</td>
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<td></td>
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<td>Goal dimension factors*</td>
<td>No factor analysis conducted</td>
<td>3 Factors: -Commitment -Attainability -Progress in goal achievement</td>
</tr>
</tbody>
</table>

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*aThe first entry represents the dimension closest in meaning to PLI,

*bThe first factor is the one on which the dimension closest in meaning to PLI obtained the highest factor loading.
As evident in Table 1, in many studies goals were categorized as pertaining to different goal domains. However, procedures for categorizing goals varied across studies and goal concepts. Often, trained coders categorized the goals (e.g., Cross & Markus, 1991; Emmons, 1989; Hooker, 1999; Lecci et al., 1994), but in some studies participants were also asked to indicate whether their goals belonged to a specified goal category after they had completed their
list of goals (Cantor, Norem, Brower, Niedenthal, & Langston, 1987; Cantor & Langston, 1989). Alternatively, goal domains have also been prespecified, and participants were asked to identify only those personal goals that pertain to the selected categories (Brunstein, 1999; Brunstein, Schultheiss, & Grässmann, 1998). The transition from idiographic approaches allowing persons to identify their goals without any constraints on goal content to nomothetic approaches employing lists of goal domains is thus smooth.

**Nomothetic approaches to personal goals.** In contrast to idiothetic goal concepts, nomothetic approaches to personal goals have less often been systematically reviewed and compared. And where this has been done, the interest usually was in identifying taxonomies of human goals (Emmons, 1997; Ford, 1992; Novacek & Lazarus, 1990). The nomothetic approaches to be discussed now do not aim at an all-encompassing categorization of human motives and goals. Rather, the interest is in how people perceive the provided goals along one or more goal dimensions. Again in contrast to many idiothetic approaches, most nomothetic approaches to personal or developmental goals do not represent an entire theory on personal goals with a set of underlying assumptions explicitly stated. Still, all approaches are committed to the view that goal striving is central to human life and human development, which are embedded in a sociocultural context (e.g., P. B. Baltes et al., 1998; Brandtstädter, 1998).

The nomothetic goal concepts, too, have been chosen based on their inclusion of goal dimensions pertaining to the importance-commitment group. In addition to the approach taken with personal life investment, six other nomothetic approaches involving a goal list have been identified (Brandtstädter & Baltes-Götz, 1990; Emmons & Diener, 1986; Holahan, 1988; Hooker & Siegler, 1993; Rapkin & Fischer, 1992a, b; Roberts & Robins, 2000). Note that the researchers cited with purely nomothetic studies often have also conducted several idiothetic studies. That is, researchers have used the two approaches in a complementary fashion rather than arguing about a single best way to study personal goals.

**Goal dimensions.** The number of goal dimensions considered in each of the studies varies between one and 35 (Table 1). Various dimensions pertaining to the more positive and more negative aspects of goals have been considered, such as investment, effort, or absorption, importance, commitment, enjoyment, difficulty, control, progress, and also stress and strain. Whenever the goal dimensions have been factor-analyzed in one or more of the cited studies, the derived factors were included in Table 1. The number of factors ranges between three and five. As already mentioned, the factors relevant to goal investment generally represent importance and commitment (Austin & Vancouver, 1996) as evident in factors like “intensity of valence,” “importance-absorption,” “value,” or “commitment.” However, we also see some differences
between factor solutions depending on the assessed goal dimensions. For instance, in Emmons’s (1986) study, the dimensions effort and importance did not receive their highest loadings on the same factor. Importance only loaded on the degree of striving factor, effort had the highest (albeit negative) loading on the ease factor and a smaller loading on the degree of striving factor. In this case, expanded effort was more strongly related to the perceived difficulty of goal attainment than to importance and commitment, although the latter relation was also present. Similarly, McGregor and Little (1998) did not obtain loadings above .50 for absorption on any of their five factors, concluding that this dimension is not highly relevant to the factor solution. In contrast, the dimensions of importance and commitment received the highest loadings on the integrity factor reflecting personal projects that are consistent with core values of the person and high in self-identity. Goal importance and commitment are thus more closely linked to personal values and meaning than investment and will produce a separate factor if the remaining dimensions are chosen accordingly.

Nevertheless, the overall picture shows that dimensions representing energy investment, importance, or commitment can be separated from dimensions pertaining to attainability of the goal, progress in goal pursuit, or the perceived social desirability of the goal. The value or importance of a goal or goal commitment is more crucial for high investment in goal pursuit compared to considerations about the difficulty or controllability of goal pursuit or social evaluations of the goal (although these dimensions are not unrelated to investment, and factor solutions depend on the set of goal dimensions employed). In line with this finding, it has been demonstrated that the importance of a goal predicts behavioral investment in the goal (frequency of goal-relevant activities or time spent in goal-relevant situations) as assessed via experience sampling methods (Cantor & Fleeson, 1991; Cantor et al., 1991; Emmons & Diener, 1986). Goals with high commitment or positiveness ratings further elicited more goal relevant thought (Klinger, Barta, & Maxeiner, 1980).

So, can we conclude that personal life investment is just an alternative indicator of goal importance or commitment? Of course, perceived goal importance, goal commitment, and goal investment need to show substantial correlations—who would spend most of her or his time engaging in activities that are not important? But still, there are some differences between valuing a goal and actually pursuing it. On identical scales, goal importance generally received higher ratings than relevance of the goal for current action, although the difference between the two

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2 Some authors use “goal investment” and “goal importance” synonymously (e.g., King & Burton, 2003; Pomerantz, Saxon, & Oishi, 2000), which renders the question futile. In contrast, here, goal investment or personal life investment does not mean importance but rather energy invested in terms of action and thought. With this concept of investment, importance and commitment become more similar to each other than to investment in that they both imply high valuation of a goal. Both dimensions can be contrasted to investment as an indicator of energization in service of a goal (theoretically, even highly valued goals do not necessarily receive a large share of investment).
ratings declined with increasing age (Brandtstädter, Renner, & Baltes-Götz, 1989). Further, stability coefficients for goal importance ratings were much higher (around .70 to .80 across a few months) than stability coefficients for effort invested in goal striving (around .50 to .60; Emmons, 1986). Our perceptions of goal importance are thus less volatile than our attempts at achieving goals. This finding is probably a reflection of the fact that goal pursuit—in contrast to goal importance and also goal commitment—is strongly influenced by the immediate context and underlies several social rules as to where, when, and how it is appropriate to pursue specific goals (Cantor, 1994; Cantor & Fleeson, 1991). Most importantly, goal importance and goal investment show different correlational patterns (the possibility for importance and effort to load on different factors has already been mentioned). For instance, in predicting well-being, effort was among the best predictors of positive affect, whereas importance best predicted life satisfaction (Emmons, 1989; see also Emmons, 1986). It has also been suggested that having important goals that reflect one’s values and are consistent with one’s identity contributes to a feeling of meaning in life, and being efficacious in goal pursuit and making progress toward goals contributes to a feeling of happiness (McGregor & Little, 1998). As goal importance or commitment foster energy investment, which in turn leads to progress toward the goal, investment is probably related to meaning as well as to happiness and positive affect. Still, as investment can also be enhanced through goal difficulty, correlations between goal investment and meaning in life are expected to be of smaller magnitude than those between goal importance and meaning in life.

Besides looking at factor analytic results, the correlations between various goal dimensions and goal investment are of interest. However, a complete correlation matrix among goal dimensions is only rarely included in the various articles or chapters. Where this has been done, we see that, in addition to positive correlations with importance (see also Pomerantz, Saxon, & Oishi, 2000; Sielaff, 2001), goal investment is positively related to difficulty of goal attainment and negatively to probability of success if no action is taken (Emmons, 1986). Effort investment is also positively related to perceived success in accomplishing the goal, the predicted impact of failure to accomplish the goal, and positive emotions (Pomerantz et al., 2000). Similarly, Novacek and Lazarus (1990) reported positive correlations between effort investment, expecting to achieve the goal, and predicted distress if the goal is not attained. They further demonstrated that correlations between effort, expected achievement, importance, and distress in reaction to failure within one goal domain were much higher than correlations between perceived effort investment across six different goal domains. Goal investment hence belongs to a self-regulatory system that operates within goal domains rather than across goal domains.

In sum, personal life investment is part of a motivational-affective system operating during goal pursuit. The content measured with the PLI Schedule is nearly identical to the
content measured with the goal dimensions of absorption, investment, or effort (Table 1). This global dimension of goal investment was found to be most similar to the goal dimensions of importance and commitment, and usually the three dimensions loaded on a common factor. Still, goal investment is not completely identical to the other two dimensions and can be expected to assess some unique content, namely, what the person actually does in service of the goal. Moreover, PLI or goal investment can be enhanced through perceived goal importance and commitment but also through difficulty in achieving the goal. Thus, goal investment is not only sensitive to what a person desires and values, but also to the necessities posed by specific goals, with goals that require more effort to be achieved also receiving a larger share of energy investment. High investment further tended to pay off as revealed through positive correlations with perceived goal attainment or progress toward the goal.

\[ b \quad \textbf{Negative Aspects of Goal Striving} \]

Being invested in the pursuit of personally meaningful goals has thus far been related only to positive precursors and outcomes like goal importance, goal attainment, positive affect, or life satisfaction. But this is not the entire story. As with any other construct generally held to be “beneficial” or “positive,” there are some perils inherent to goal striving (cf. Brunstein, Schultheiss, & Maier, 1999; Carver & Scheier, 1998; Higgins, 1996; King & Burton, 2003; Schönpflug, 1985).

Returning to factor-analytic results, we find that the goal dimensions of being absorbed in goal pursuit and goal importance loaded on factors associated with stress and strain experienced during goal pursuit (Cantor & Langston, 1989; Ruehlman & Wolchik, 1988). Similarly, increased effort put into achieving goals and increased goal importance were both positively related to increased worrying over personal goals (Pomerantz et al., 2000). Our thoughts are often preoccupied with unexpectedly difficult or challenging goals (Klinger et al., 1980). Furthermore, spending much time pursuing important goals can enhance negative affect and reduce positive affect in some people (Emmons & Diener, 1986). Hence goal investment, besides being crucial for goal accomplishment and life satisfaction, also serves as an avenue to worry, anxiety, and negative affect. And this is merely the “normal” state of striving for important goals. The situation becomes worse if actions are inefficient or goal attainment becomes entirely impossible.

Self-regulation, that is, striving for personal goals, consumes external and internal resources (Baumeister & Heatherton, 1996; Schönpflug, 1985). Sometimes resources are wasted on actions that do not result in reaching the goal but rather augment problems or create adverse side- and after-effects. Those dysfunctional actions increase stress and can lower subjective estimates of one’s competence and self-esteem (Schönpflug, 1985). Failure to accomplish a goal
poses additional threats. First of all, the person needs to know when it is time to give up the goal and stop investing still more effort (Brim, 1992; Carver & Scheier, 1998). Especially highly valued goals, however, can lead to perseverance in hopeless situations (King & Burton, 2003). Second, even if we accept failure, goal disengagement exacts a psychological cost (Klinger, 1975, 1977). Failure to attain important goals initiates rumination (L. L. Martin & Tesser, 1989). Defeats further cause psychological upheavals that result from the need to disengage from prior commitments. This incentive-disengagement cycle involves feelings of frustration, anger, sadness, or even depression (Klinger, 1977).

The detrimental effects of goal failure can be further enhanced or reduced depending on one’s personality. People who perceive their self-esteem to be contingent on or link their personal happiness to the accomplishment of specific goals are especially hard hit by failure to attain those goals (Kernis, Cornell, Sun, Berry, & Harlow, 1993; McIntosh, Harlow, & Martin, 1995). Similarly, whether someone believes in the malleability of personal traits and strives for constant learning and improvement (learning goals) or holds that traits are fixed entities and is concerned with documenting his or her positive traits (performance goals) can moderate responses to difficulties and failure (Dweck, Higgins, & Grant-Pillow, 2003). Finally, individuals who are prone to state orientation (i.e., persevering cognitions related to the present, past, or future state) are especially impaired in goal pursuit following failure (e.g., Kuhl, 2001).

In sum, each rating of personal life investment reflects positive (e.g., planning, making progress toward goals, evaluating satisfactory results of action) and negative (e.g., worrying, rumination, inefficient action, disengaging) aspects of striving. Nevertheless, we cannot conclude that it would be better not to invest in personal goals or pursue only unimportant goals or goals that are easy to accomplish (King & Burton, 2003). Humans always pursue some kind of goal and those goals can give structure to a person’s life and infuse activities with personal meaning if they are self-relevant, valued, and challenging (e.g., Baumeister, 1991; Erikson et al., 1986; Klinger, 1977). Thus, “goal engagement is a necessity of life” (Carver & Scheier, 1998, p. 346). The ambivalence of goal investment is merely a reflection of the ambiguity of life (cf. Aspinwall & Staudinger, 2003; Chang & Sanna, 2003). The experience of stress, worry, challenge, and failure during goal striving is often not a result of being unable to select and organize personal goals but rather an inevitable by-product of being the producer of one’s development. There is no way to eliminate all negative aspects of personal life investment. Still, there are some dysfunctional kinds of investment that can be reduced or avoided and we can ask how this reduction of negative and enhancement of positive aspects of goal striving can be achieved. Specifically with regard to old age, the question whether there can be too much of a good thing will again be considered.
3 Actions and Thoughts

In addition to personal goals as mid-level to high-level elements in a goal hierarchy, actions and thoughts can be linked to the goal hierarchy. Concrete action goals or “do” goals have been located on the lowest hierarchical level (cf. Carver & Scheier, 1998). These goals specify which actions are to be performed in a given situation and are constantly adapted to behavioral outcomes and contexts. In the following, the meaning and components of action and thought are discussed more thoroughly. Here, some differences between the two constructs and their relations are illustrated. It should become evident that any statement about goal engagement reflects more than processes of actual goal pursuit.

Actions are commonly defined as those categories of behavior that can be predicted and explained with reference to intentional states, are at least in part under personal control, and are performed because the person has chosen to do so (e.g., Brandtstädter, 1998, 2001; Greve, 2001). Following this definition, intentions are constitutive parts of actions, that is, actions and intentions become logically dependent (Greve, 2001). This means that, strictly speaking, we can directly observe behavior, but we can never directly observe action, as actions need to be guided by unobservable intentions and goals. Consequently, action-theoretical approaches have put their emphasis not solely on behavior that is readily accessible to direct observation but also on cognitive activities relevant to goal setting and goal pursuit.

Action can be conceptualized and studied in two complementary ways: Action has a hierarchical deep structure and also a sequential surface structure (Hacker, 1985a, 1986, 1994). The hierarchical deep structure is evident in the link between action and the goal hierarchy. Actions are motivated and regulated by higher-order goals (e.g., Carver & Scheier, 1998; Hacker, 1985a, b; von Cranach et al., 1982). Viewing action as embedded in a hierarchical structure helps to illustrate the complexity and multiple meanings inherent in each action. A specific action is never an isolated occurrence but is located in a broader field of actions and goals. Whenever we think about an action as an expression of one specific goal, we need to be aware that this is merely a simplification of the real state of affairs. Actions and goals relate to each other and to a wide range of substitutable behaviors. We can describe this complex goal network with the structural properties of equifinality and multifinality (Shah & Kruglanski, 2000). Equifinality means that goals can be attained through a number of different actions, that is, if one action cannot be carried out another action may substitute for it in pursuing the goal (Shah & Kruglanski, 2000; Winell, 1987; see also Gollwitzer & Wicklund, 1985). Just as goals usually have more than one means of

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3 Carver and Scheier (1998) include motor control goals on a still lower level than “do” goals. However, as action is rarely represented on the level of motor goals those kinds of goals are subsumed under the label of action goals.
accomplishment, any action serves more than one goal. This property is referred to as the multifinality (Shah & Kruglanski, 2000) or multipotentiality (Winell, 1987) of goals and actions, but the idea is also part of such concepts as the polyvalence or overdetermination of actions (Boesch, 1991; Brandstätter, 1998, 2001). However, polyvalence is a broader concept than multifinality (cf. Boesch, 1991). It involves the notion that action always has more than one meaning: There are subjective and objective, private and cultural, or short-term and long-term meanings. Every action further is not only related to the goal that is directly put into operation during this action, but also to every superordinate goal that is related to that goal. Thus, actions that look similar can be very dissimilar as to their meaning. In addition, there is not just one reason for acting but always several reasons. Polyvalence further means that actions and goals may conflict, that is, an action that serves one goal may well have detrimental effects on another goal that is also valued. The amount of conflict and mutual facilitation of goals within a goal network has proven an interesting and important aspect of studying and understanding personal goal hierarchies (e.g., Emmons, 1996; Riediger, 2001; Wiese, 2000).

The sequential surface structure of action, that is, the entire course of an action, is described in detail in many action-theoretical models (cf. Boesch, 1991; Hacker, 1985a, 1994; H. Heckhausen, 1991; H. Heckhausen & Kuhl, 1985; Schönplugh, 1985; von Cranach et al., 1982; Werbik, 1978; Zimmerman, 2000). In spite of differences between theoretical models, there are some components of action that are considered in most theories on action or self-regulation. These include a phase preceding observable behavior that involves, for instance, forethought, constructing a model of the situation, setting a goal, and devising a strategy for goal pursuit. A second phase can be seen in the execution of the planned action and the exercise of volitional control that protects the action from being interrupted. When the action is completed, feedback about the consequences of this action is processed and evaluated during a final phase.

*Thoughts* are the “constant stream of images that cross the field of our consciousness” (Klinger, 1977, p. 27). Thought rests on a motivational, social, and affective base, as repeatedly shown in research on social cognition (e.g., Bandura, 1986; S. T. Fiske & Taylor, 1991; Hess & Blanchard-Fields, 1999; Malle, Moses, & Baldwin, 2001). Thoughts are closely related to intentions and goals: The content of thoughts often reflects the goals to which people have committed themselves (Klinger, 1977, 1992). In contrast to action, however, not all thought is intentional, that is, directed by goals. People worry, ruminate, or daydream without wanting to do so or even in spite of not wanting to do so. Thought can thus be intentional or operant (e.g., when people try to solve a problem, make a plan, or remember a past event) and unintentional or respondent (e.g., mind-wandering, incidental thoughts, reveries, rumination; cf. Klinger, 1977). With these properties, thoughts can be both the friends and foes of actions.
The relation between action and thought. Sequential models of action (see above) have illustrated how thought is an integral part of action. Thoughts accompany the long way from wishes to action. They are involved in generating wishes, determining whether a wish can possibly be attained through action, accumulation and processing of wish-relevant information, forming and remembering intentions, action planning, determining when the time is right to enact intentions, and evaluation of action outcomes (H. Heckhausen & Kuhl, 1985; see also D. Dörner, 1985). In this regard, thoughts are the friends of action.

However, thoughts may also become the foes of action, as detailed in Kuhl’s personality systems interaction theory (PSI theory; Kuhl, 2000, 2001; Kuhl & Fuhrmann, 1998) but also in other work on the detrimental effects of rumination on goal pursuit (e.g., Klinger, 1977; Lyubomirsky, Tucker, Caldwell, & Berg, 1999; L. L. Martin & Tesser, 1989). PSI theory aims at describing the dynamic interplay of various psychological systems involved in action regulation. Within this theory, a possible negative consequence of thought on action is illustrated: When degenerated intentions (i.e., intentions that the person cannot enact but also cannot disengage from) are excessively activated in memory they take up working memory capacity, reduce the efficiency of other cognitive activities, and thus inhibit the initiation of other intended actions. Moreover, if the activation of degenerated intentions also leads to decreased positive or increased negative affect, this may further compromise effective self-regulation. PSI theory stresses the significance of positive and negative affect for action regulation. Positive affect is seen as central to the initiation of action, while absence of positive affect helps to inhibit action initiation even if an intention is currently activated in memory. Absent or downregulated negative affect is essential to access implicit self-representations. That is, the self-congruence of an action can be evaluated with low negative affect. In contrast, the experience of negative affect fosters the processing of self-discrepant information. Thus, positive and negative affect impact on volitional efficiency (i.e., performing intended actions at the right time) and self-development (i.e., choosing goals that match one’s wishes, needs, and values). Thoughts that evoke positive or negative affect can hence facilitate or hinder self-regulatory functions—depending on the current situation.

To sum up, although thought is involved in most actions (apart from highly automatized actions) there are many thoughts that are not linked to overt action but still related to a person’s wishes and goals. Or, as Klinger (1992) put it, “when we are reminded of a goal and can profitably take immediate action toward it, we act, and when we cannot act we think” (p. 134). Thereby, thought without overt action can help to maintain or increase motivation for goal pursuit, remember goals, or help to derive strategies for goal pursuit. But thought can also arise in reaction to threatened or entirely blocked goals and this kind of thought interferes with the pursuit of alternative goals. As personal life investment comprises both action and thought,
various kinds of thoughts may be considered in addition to overt action when reporting on one’s PLI. This issue will again be considered when hypotheses on the correspondence between PLI and activity data are derived.

4 The Self-Concept

The construct of a goal hierarchy, combined with the consideration of action-theoretical approaches, helps to illustrate the relation between personal goals, activities, thoughts, and PLI as indicative of engagement with goals. However, the goal hierarchy cannot provide the basis for a comprehensive model of all systematic relations between PLI and other elements of the self-system. As previously mentioned, the goal hierarchy is primarily a model of self-regulatory processes but does not allow studying of the entire knowledge structure inherent to the self. That is, knowledge about personal goals, possible selves, current concerns, and so forth (the “what” of behavior) is represented in the goal hierarchy, but knowledge about all of one’s past, present, and possible future personality traits, beliefs, attitudes, or competencies cannot easily be incorporated. The self-concept is another aspect of the self-system that can complement the heuristic model of a goal hierarchy in this regard.

The self-concept can be defined as the part of the self-system that reflects how people think about themselves, that is, the content of self-representations, self-schemas, internal models of the self, or a theory about oneself (e.g., Epstein, 1973; Filipp & Mayer, in press; Kihlstrom & Cantor, 1984; Markus & Wurf, 1987). It has been studied under many different labels, such as possible selves, self-definitions, or personality dispositions—all of which are subsequently considered. Furthermore, the self-concept is a multifaceted phenomenon that consists of multiple representations or elements that vary across several dimensions (e.g., Filipp & Mayer, in press; Greve, 2000; Markus & Wurf, 1987; Staudinger & Greve, 1997). We find, for instance, variations in (a) the centrality or importance of self-representations, (b) the temporal orientation (past, present, future) of self-representations, (c) whether self-representations are real or possible (what one actually is vs. what one would like to be, could be, or ought to be), and (d) whether self-representations are mere descriptions or involve evaluations of oneself.

**Personality dispositions.** Personality traits, as part of the self-concept, have traditionally been studied with questionnaires that assess relatively stable person variables, such as the Big Five (e.g., Costa & McCrae, 1997). Like personal goals, personality traits have often been depicted in a hierarchical organization with broad traits like extraversion, neuroticism, openness, conscientiousness, and agreeableness representing the highest level of the hierarchy, followed by more
specific traits like sociability or activity and finally by specific behavioral responses, such as talkative or energetic (cf. Caspi, 1998; Hampson, John, & Goldberg, 1986). This of course leads to the question of the relation between personality traits and personal goals or motives. Are personality traits a sort of high-level goal? Although goals and traits have been linked theoretically and empirically (B. R. Little et al., 1992; Roberts & Robins, 2000) one can find both answers—yes and no—in the literature (cf. Roberts & Robins, 2000; Winter, John, Stewart, Klohnen, & Duncan, 1998). There is no doubt that personality traits are somehow related to goals and motives, but there has been some debate as to how they are related. Here, I would like to offer a view that is compatible with much of the literature. First of all, it seems important to conceptualize personality dispositions in broad terms, that is, to define personality dispositions as “individual differences in the tendency to behave, think, and feel in certain consistent ways” (Caspi, 1998, p. 312) or as differences in the “chronic accessibility or activation levels of the particular mental-emotional representations—the cognitions and affects—the person has available” (Mischel & Shoda, 1998, p. 237). Within this concept, two kinds of personality dispositions can be differentiated: motives and traits (Winter et al., 1998). Motives refer to people’s relatively enduring wishes, desires, and values, that is, states of affairs that they would like to bring about (consciously and unconsciously). Traits can be defined as stylistic and habitual patterns of cognition, affect, and action, that is, form aspects of behavior. Traits often show some continuity with childhood temperament (cf. Caspi, 1998; Rothbart & Bates, 1998; see also C1). When personal goals are formed, traits and motives interact. Traits channel or direct the behavioral expression of motives. Or, in simple terms “traits answer the question ‘how?,’ motives answer the question ‘why?,’ and both concepts address the question ‘what?’” (Winter et al., 1998, p. 238). Thus, personality traits are not goals per se, but they contribute to the formation of personal goals. The mid-level personal goals or personal action constructs described in section C2 result from an interaction between motives or highest-level goals, personality traits, and developmental contexts (cf. Brandtstädter, 2001; Brunstein, Maier, & Schultheiss, 1999; Cantor, 1990, 1994). Goals are specifications of one’s motives and wishes that have been adapted to one’s personality traits and contextual opportunities and demands. That is, traits and contexts moderate and regulate the transformation of highest-level goals into more concrete subgoals that subsequently guide behavior. In addition, personality traits and contexts impact on the initiation and production of behavior. For instance, if a person does not believe that she or he can reach a specific goal in a given situation, this person will not start to act.

In sum, personality traits can be linked to goal striving in two ways. First, they channel the expression of high-level goals and thus facilitate or hinder the behavioral expression of motives and wishes. A person knows how she or he typically acts and feels in a particular
situation and—if possible—will refrain from pursuing high-level goals that require entering into situations that may provoke inappropriate actions, negative affect, or failure (cf. Winter et al., 1998). Second, as form aspects of behavior or expressions of temperament in adulthood, they are indicative of biologically-based interindividual differences in acting and reacting during goal striving (see section C1 on life mechanics). In this study, the personality traits of extraversion, neuroticism, openness, and internal control beliefs are considered. But before these personality dispositions are explicitly related to personal life investment, let me introduce two more constructs that can be subsumed under the heading “self-concept.”

Possible selves (e.g., Markus & Nurius, 1986; Markus & Ruvolo, 1989) have already been introduced as representations of the self in future states, which provide an essential link between the self-concept and motivation. Possible selves are assessed as what a person hopes to become (hoped-for selves) and what a person dreads becoming (feared selves; Cross & Markus, 1991; Markus & Nurius, 1986). The formation of a possible self, in essence, is only limited by a person’s imagination. In contrast to most other goal constructs, the identification of a possible self does not depend on whether this self is achievable, relevant for current action, or confirmed by social experience. Nevertheless, unrealistic possible selves are unlikely to be particularly effective motivators (Markus & Ruvolo, 1989; see also Oettingen, 1996). Consequently, possible selves are often constructed in the domains of one’s current involvement and expertise. This means that possible selves are closely linked to one’s present self-definition.

The self-definition is the subsystem of self-related knowledge that is constitutive for this person as compared to other persons. It contains subjectively most important characteristics, self-representations that are essential to experience personal continuity across time, and knowledge that is central to one’s biography (cf. Brandstädter & Greve, 1994; Epstein, 1973; Freund, 1995; Freund & Smith, 1999a; McGuire & McGuire, 1988; Wicklund & Gollwitzer, 1982). In contrast to self-definitions that exclusively refer to the past, self-definitions that involve the present or future are never given or self-evident. Rather, those self-definitions and identities continually seek validation: People are motivated to achieve a significant audience’s favorable evaluation and subsequently keep their reputations in good shape (e.g., Baumeister, 1982; Breckler & Greenwald, 1986; Goffman, 1967; Hogan & Roberts, 2000). Thus, important parts of the self-definition can be conceptualized as a claim to have the potential to successfully enact certain classes of behavior (Gollwitzer & Wicklund, 1985; Wicklund & Gollwitzer, 1982). The recognition of short-comings in making progress toward a certain self-definition has been shown to lead to a sense of incompleteness that motivates self-symbolizing efforts (Brunstein & Gollwitzer, 1996; Gollwitzer & Wicklund, 1985). That is, failure to demonstrate the possession of
an attribute or skill relevant to a self-definition motivates the individual to compensate for this failure by demonstrating the possession of other relevant attributes or skills or otherwise gaining social recognition for the threatened self-definition. Self-definitions thus continuously give rise to self-defining goals that need to be achieved in order to maintain a specific self-definition. Those self-defining goals are included in the personal goal hierarchy in addition to many non-self-defining goals (cf. Gollwitzer & Wicklund, 1985).

It should be evident from this description that the self-concept contains many elements that are also part of the current personal goal hierarchy. This overlap is most obvious in the constructs of possible selves or self-defining goals. Nevertheless, the self-concept is not completely included in the goal hierarchy and the goal hierarchy is not completely included in the self-concept. The goal hierarchy, but not the self-concept, incorporates unconscious or implicit motives (e.g., McClelland, Koestner, & Weinberger, 1989) or “auto-motives” (e.g., Bargh, 1990) in addition to consciously held goals across all levels of the hierarchy. In contrast, the self-concept contains primarily high-level goals in addition to knowledge about past, present, and possible future traits, experiences, roles, values, beliefs, or attitudes.

5 Functioning of Obligatory and Optional Personal Life Investment

Various self-regulatory concepts and constructs, such as personal goals, possible selves, actions, thoughts, and self-definitions have been introduced. Still, in the study of goals and action it has been important not only to collect and describe different goals and actions but also to describe and explain similarities and differences in their origins and the related self-regulatory processes. People engage in goal-directed behavior for different reasons, formulate goals in different ways, and experience different kinds of affect during goal striving. In previous sections, the impact of personal dispositions on goal striving has been discussed: For individuals high on avoidance temperament goal striving is associated with more negative motivations and experiences than it is for individuals low on avoidance temperament. But is the experience of goal striving only dependent on personal characteristics? Surely not. The differentiation between obligatory PLI and optional PLI (see B3) has been made to stress the role of a person’s developmental context during the selection and pursuit of goals. Developmental contexts “dictate” to some extent where energy and effort need to be invested (obligatory investment) but also allow for much choice as to where and when to invest (optional investment). As previously discussed, this means that obligatory PLI and optional PLI play a different role for development. The differences in origin and functionality of obligatory PLI and optional PLI are also expected to be reflected in different self-regulatory processes during obligatory and optional investment.
Reasons for striving and regulatory focus. Many theories on behavior, personal goals, the self, self-regulation, or developmental regulation have concerned themselves with factors that can account for different motivational and affective antecedents and consequences of goal striving. Two such factors are (a) the reason for striving, and (b) the regulatory focus behind striving. Reasons for striving were often studied along the dimension of intrinsically versus extrinsically motivated behavior (e.g., deCharms, 1968; Deci & Ryan, 1987; Harter, 1981; Ryan & Connell, 1989; Ryan, Sheldon, Kasser, & Deci, 1996; Vallerand & Bissonnette, 1992). Basically, a distinction is drawn between the self and forces external to the self as central reasons for action. Regulatory focus was often conceptualized in terms of approach and avoidance (e.g., Elliot & Sheldon, 1998; Elliot, Sheldon, & Church, 1997; Higgins, 1987). That is, whether actions aim at a discrepancy reduction between a current and a desired state or at a discrepancy enlargement between a current and an undesired state (cf. Carver & Scheier, 1998). Both distinctions provide an interesting theoretical background to learn more about the self-regulatory processes involved in obligatory PLI and optional PLI. As shown in Table 2, obligatory investment can be linked to both internal and external causes and a focus on approach and avoidance, whereas optional PLI can be linked only to internal causes and a focus on approach. The theoretical assumptions underlying Table 2 shall now be made explicit. However, it seems important to first introduce the table to aid comprehension of the arguments to follow.

Table 2

<table>
<thead>
<tr>
<th>Domain</th>
<th>Obligatory Investment</th>
<th>Optional Investment</th>
</tr>
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<tbody>
<tr>
<td>Mode of regulation</td>
<td>Autonomous and controlled</td>
<td>Autonomous</td>
</tr>
<tr>
<td>Reasons for behavior</td>
<td>Attitudes and subjective norms</td>
<td>Attitudes</td>
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<tr>
<td>Mode of developmental regulation</td>
<td>Proaction and reaction</td>
<td>Proaction</td>
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<td></td>
<td>Internal and external causes</td>
<td>Internal causes</td>
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<tr>
<td>Life mechanics</td>
<td>Behavioral approach and inhibition systems</td>
<td>Behavioral approach system</td>
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<tr>
<td>Personal goals</td>
<td>Approach and avoidance goals</td>
<td>Approach goals</td>
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<tr>
<td>Self-concept</td>
<td>Ideal and ought selves</td>
<td>Ideal selves</td>
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<td>Possible selves</td>
<td>Hopes and fears</td>
<td>Hopes</td>
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<tr>
<td></td>
<td>Approach and avoidance focus</td>
<td>Approach focus</td>
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</tbody>
</table>

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Before the individual constructs in Table 2 can be discussed two basic questions need to be answered: (a) What is the connection between the two distinctions of internal versus external causes and approach versus avoidance focus? That is, why can obligatory PLI and optional PLI be related to the two dimensions in the same way? (b) Why is obligatory PLI related to internal and external reasons and approach and avoidance, while optional PLI is only related to internal reasons and approach?

Carver and Scheier (1998, 2003) have provided a cogent answer to the first question: Although the external-internal and approach-avoidance distinctions may seem different at first sight, they can be easily reconciled. The reason for goal striving impacts on the regulatory focus during goal pursuit. Goals that are pursued for intrinsic reasons imply an approach process, whereas goals that are pursued for external reasons are structurally more complex in that they imply both an avoidance process and an approach process (Carver & Scheier, 1998, 2003; see also Elliot & Thrash, 2002). For instance, a child who feels compelled to receive good grades in school because that is what his parents expect of him (external reason for action) will try to attain good grades (approach process). However, receiving good grades simultaneously serves to avoid disapproval by his parents or feeling guilty because he did not live up to expectations (avoidance process). In contrast, engaging in a behavior for purely internal reasons implies that one does not expect external sanctions or feelings of guilt as a consequence of failure and hence no avoidance process is involved. As approach processes are thus involved in both intrinsically and extrinsically motivated actions, “the difference between goals that connect to the true self and goals that don’t may reduce to whether the fundamental impulse stems from an approach system or from an avoidance system” (Carver & Scheier, 1998, p. 102). Consequently, the only feature that distinguishes intrinsic and extrinsic motivation is the occurrence of a regulatory focus on avoidance with extrinsic motivation: Internal reasons for action are linked to approach and external reasons for action are linked to approach as well as avoidance.

To answer the second question, it is necessary to consider the reasons for investing in obligatory life domains and investing in optional life domains. Again, two kinds of reasons can be identified: The demands of one’s developmental context (external reasons) and individual preferences and choices (internal reasons). Both contextual demands and individual preferences are expected to be strong forces in obligatory PLI, whereas individual preferences are expected to be the central motivators behind optional PLI. Consequently, approach and avoidance processes are related to obligatory PLI, but approach processes prevail with optional PLI. However, as the assessment of obligatory PLI and optional PLI is based on ratings of broad life domains rather than individual goals, this conceptualization is to be considered as relative rather than absolute. The various goals across optional life domains are not all intrinsically motivated and purely
focused on approach. Even in optional life domains people may face contextual demands that require investments and hence imply an avoidance process. Still, the internal-external and approach-avoidance distinctions can help to illustrate the dominant modes of regulation during obligatory and optional PLI. As mentioned above, both what the person truly wants and environmental pressure or societal norms are strong forces in the regulation of obligatory investment. In contrast, as optional PLI draws on “left over” resources or takes place during one’s free time, the genuine interests and wishes of the person become the dominant regulatory forces during optional investment. External pressure or norms assume a negligible role. This does not imply that avoidance processes can never operate during optional PLI. But it is possible to set predominantly approach goals in optional life domains. Employing the picture of the goal hierarchy, the meaning of dominant regulatory focus can alternatively be framed as the regulatory focus of higher-level goals as compared to lower-level goals. Within optional goal domains we can expect to find predominantly approach goals on intermediate to high levels of the goal hierarchy (e.g., travel around the world), whereas lower-level goals may also comprise some avoidance goals (e.g., avoid being robbed during sightseeing). Obligatory PLI, in contrast, cannot be governed by a regulatory focus on intrinsic reasons or approach alone. Several external or avoidance goals are expected to be present in addition to a large number of approach or internal goals on intermediate to high levels within obligatory goal domains. That is, although approach still figures more prominently than avoidance in obligatory goal domains it cannot permanently play the dominant role. Rather, the regulatory focus changes across different goals, times, and situations, which means that sometimes avoidance motivation becomes the dominant motivational force. This kind of investment may increase negative affect during goal striving. Still, in order to avoid long-term negative developmental consequences it may be necessary to accept short-term negative consequences to one’s affective balance.

After these general comments, let us consider in more detail the different constructs summarized in Table 2. The theoretical approaches resting on the distinction between more external or more internal reasons for action form a quite heterogeneous group. Besides the autonomous versus controlled distinction in self-determination theory (e.g., Deci & Ryan, 2000), the external-internal distinction can be found for specific actions and also on a broader level concerning developmental regulation. Moreover, four conceptualizations that are relevant to the approach-avoidance distinction have been identified.

Different conceptualizations of internal and external causes. Self-determination theory focuses on whether the person acts for intrinsic reasons, that is, in an autonomous way, or for extrinsic or controlled reasons. Here, external and internal forces represent the two ends of a continuum instead of representing a dichotomy. This continuum of reasons for action ranges from external
over introjected, identified, and integrated to intrinsic (cf. Deci & Ryan, 2000; Ryan & Connell, 1989; Sheldon & Houser-Marko, 2001; Vallerand & Bissonnette, 1992). External reasons are those where behavior is felt to be externally regulated and is explained by reference to avoiding negative consequences like punishment or criticism, or by reference to desiring external rewards. Introjected reasons are related to internal pressures to act, namely the desire to avoid negative self-evaluations, guilt, or shame or to achieve positive self-evaluations. Identified reasons involve acting from values that have been accepted as important. Integrated reasons move one step further in that the importance of behaviors has been realized and accepted and, in addition, those behaviors have been integrated with other aspects of the self. Finally, behavior explained by intrinsic reasons is performed for its inherent enjoyment or pleasure. The degree to which action is seen as self-determined or autonomous, that is, caused by intrinsic, integrated, or identified reasons, has been shown to be an important predictor of high motivation and improved performance during goal pursuit as well as improved physical and psychological well-being (for overviews see Deci & Ryan, 2000; Ryan & Deci, 2000). The experience of goal striving is much more positive and enjoyable when behavior is intrinsically rather than extrinsically motivated.

The theory of planned behavior (TPB; Ajzen, 1991, 1996) proposes that attitudes, subjective norms, and perceived behavioral control determine the formation of an intention. Attitudes toward the behavior are internal reasons for action as they represent personal evaluations of the behavior in question. Subjective norms, in contrast, are more external reasons for action as they represent the perceived social pressure to perform or not perform the behavior. Perceived behavioral control is an additional determinant of intention and reflects the perceived ease or difficulty of performing the behavior. The relative importance of attitude, subjective norm, and perceived control in the prediction of intention varies across behaviors and situations. Sometimes only attitudes and perceived control make a significant contribution to the prediction of intentions and tend to overshadow subjective norms (Ajzen, 1991). It is proposed that this situation is characteristic for investment in optional goal domains but not in obligatory goal domains. The finding that the intention to search for a job (obligatory) was predicted by attitudes, subjective norms, and perceived control, whereas the intention to perform different leisure activities (optional) was predicted by attitudes and perceived control only (Ajzen, 1991) lends some support to this assumption.

Developmental regulation always involves proaction, that is, life composition with regard to internal standards “from the inside out,” and reaction, that is, life composition with regard to external demands “from the outside in” (Labouvie-Vief, 1981; see also P. B. Baltes et al., 1998; Lawton, 1989; Reich & Zautra, 1981; Staudinger, 1999b). It has been found that reactivity is
associated with negative affect and proactivity is associated with positive affect (Lawton, 1989; Reich & Zautra, 1981).

**Different conceptualizations of approach and avoidance.** The behavioral approach and inhibition systems (cf. Davidson et al., 2000; Depue & Lenzenweger, 2001; Kosslyn et al., 2002) as part of the life mechanics have already been introduced in section C1 and should warrant no further discussion here. Outside the area of physiological approaches to motivation, the approach-avoidance distinction also figures prominently. There are distinctions between approach and avoidance personal goals (e.g., Elliot & Sheldon, 1998; Elliot et al., 1997; Emmons & Kaiser, 1996), ideal selves with a regulatory focus on promotion and ought selves with a regulatory focus on prevention (e.g., Higgins, 1987, 1996, 1997), and hoped-for and feared possible selves (e.g., Markus & Nurius, 1986; Markus & Ruvolo, 1989).

The degree to which individuals tend to formulate approach as opposed to avoidance goals is often conceptualized as a personal disposition. People with a high proportion of avoidance goals tended to report reduced psychological well-being, increased psychological distress, particularly higher anxiety or neuroticism, and increased physical symptomatology (Elliot & Sheldon, 1998; Elliot et al., 1997; Emmons & Kaiser, 1996). Mediational analyses revealed that perceived progress toward the goal and perceived controlledness (i.e., acting for external or introjected reasons) mediated the relationship between avoidance goals and physical symptoms (Elliot & Sheldon, 1998). People were less successful in pursuing avoidance goals and felt more external pressure to achieve them, which was associated with more physical symptoms. In sum, avoidance goals may be “considered a psychological vulnerability that places individuals at risk for emotional and physical ill-being” (Emmons, 2003, p. 117).

But there are also researchers who suggest a more differentiated picture of avoidance goals. The presence of *matched* hoped-for selves to be approached and feared selves to be avoided in the same domain has been proposed as maximally effective in motivating goal pursuit (Markus & Ruvolo, 1989). Matched hopes and fears allow for more control over domain-specific behaviors as they provide more varied motivational resources. Fears are effective as a motivational resource when they are balanced with hopes that reflect desired states in which the feared state is avoided. Likewise, hopes can be stronger motivational resources when they are linked with feared images of what could happen if the desired state is not realized.

Higgins’ (1987, 1996, 1997) distinction between ideal selves (how the person would ideally like to be) and ought selves (how the person feels compelled to be) also reflects approach and avoidance motivation. Like the behavioral approach and inhibition systems, ideal and ought selves have been linked to different affective reactions (Higgins, 1987, 1996, 1997; see also Carver & Scheier, 1998). The affect dimension relating to approach (ideal selves) is the dimension that
runs from depression to elation. People who fail to accomplish approach goals experience dejection-related emotions, such as sadness or dissatisfaction. People who accomplish approach goals experience joy and happiness. The affect dimension relating to avoidance (ought selves) is the dimension from anxiety to contentment. Failure at avoidance goals leads to agitation-related emotions like anxiety or uneasiness, whereas successful avoidance is associated with feelings of relief or contentment (Higgins, 1987; see also Roseman, 1984). Thus, predictions based on research on the behavioral approach and inhibition systems and on Higgins’ concepts of ideal selves and ought selves converge on the assumption that approach is associated with positive, elation-related emotions (e.g., happy, eager) and avoidance is associated with negative, agitation-related emotions (e.g., anxious, nervous).

The four introduced variants of an approach-avoidance distinction have usually focused on personal dispositions toward one or the other. However, in addition to a focus on individual differences in the tendency to formulate approach or avoidance goals, it is also possible to focus on the developmental context as conducive to the formulation of approach or avoidance goals—a perspective that is central to the distinction between obligatory and optional PLI. With the approach-avoidance distinction it is often implied that the individual is free to choose whether to formulate a goal as an approach or avoidance goal (e.g., Elliot et al., 1997; Emmons, 1996). But is this really true? I believe that the role of obligatory life domains as conducive to the identification of avoidance goals, in addition to approach goals, also needs to be considered. There are goals that are naturally conceived of with a regulatory focus on avoidance. Consider an old woman who is suffering from severe osteoporosis and knows that falling will most likely lead to fractures. In this situation it seems straightforward to adopt the goal “avoid falling.” Of course, the old woman could alternatively specify her goal as “walk carefully.” Still, that would not change the essence of the underlying motivation to avoid a situation that is possibly life threatening. There is nothing to be gained from walking carefully, but everything might be lost if the woman should fall. As every avoidance behavior eventually leads into approach behavior (Carver & Scheier, 1998, 2003) the woman, in trying to stay away from her feared state, will just naturally adopt some approach goals that help her achieve this aim, for instance “use a cane when walking.” However, the formulation of a goal is less important than the belief that something important might be lost in case of failure to achieve the goal. Reacting to imminent loss will foster an avoidance focus (cf. Higgins, 1997) and hence be associated with some of the negative effects related to avoidance goals.

In sum, obligatory PLI is predicted to involve approach and avoidance orientations, external and internal causes for action, and the resulting positive (especially elation-related) and negative (especially agitation-related) affect. Optional PLI involves a less complex affective-moti-
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V ariational structure in that it comprises predominantly approach goals, internal reasons for action, and the resulting positive emotions. This characterization of obligatory and optional PLI was based on considerations about different life domains that form a person’s developmental context. However, as development always involves dynamic interactions between person and environment, the antecedents and consequences of obligatory and optional PLI also depend on the person: Individual tendencies toward approach and avoidance are hypothesized to play out differently in obligatory and optional life domains. Obligatory PLI may mean something different for a person high on avoidance temperament compared to a person low on avoidance temperament. If an avoidance temperament indicates a tendency to respond to negative aspects of one’s context, then cues suggesting imminent loss or possible sanctions, which are commonly encountered in obligatory domains, may be more strongly responded to by individuals with an avoidance temperament. In contrast, optional PLI invites the identification of intrinsic goals with a regulatory focus on approach. External pressure and avoidance goals may occur in optional PLI domains. Here, however, the individual can escape enduring pressure and refocus investment of energy and effort without risking negative consequences for development. Even persons high on avoidance temperament should be able to regulate their optional investment in a way that feels self-determined and positive.

6 Hypothesized Linkages with Personal Life Investment

Self-concepts and activities have been introduced in quite general terms in the previous chapters. Still, it seems necessary to gain a more detailed understanding of the similarities and differences in the content that is measured with PLI, self-concept variables, and daily activities.

Evidence for the reliability and validity of the construct “personal life investment” has previously been reported (Kolbe, 1996; Staudinger & Fleeson, 1996; Staudinger et al., 1999; Staudinger & Schindler, 2005; Staudinger, Smith, & Freund, 1992). For instance, retest stability of average PLI and of PLI in individual life domains across 8 weeks was shown to be in the .70 range (Staudinger et al., 1992). PLI is sensitive to non-psychological developmental contexts (Kolbe, 1996): People with part- or full-time jobs reported higher PLI in the occupational domain than people who were not working. People with high levels of education reported more PLI in the occupational domain than people with low levels of education. People who had a partner and/or children were more invested in the family domain. Moreover, PLI can be investigated across the entire adult life span and is sensitive to the changing developmental contexts and demands during different phases of the life span (Kolbe, 1996; Staudinger, 1996; Staudinger & Schindler, 2005).
With this study, I want to add to the validation of the PLI construct by showing that it is related to various other elements of life composition, namely personality dispositions, possible selves, self-definition, and daily activities. The overarching hypothesis regarding the validation of PLI is depicted in Figure 4. The figure illustrates and summarizes the considerations of the relationships between PLI, the self-concept, and daily activities that shall subsequently be discussed in more detail. Personality dispositions that reflect a tendency to engage with life in positive or negative ways, current and possible selves, and daily activities have been identified as interesting correlates of PLI. The content overlap of the four constructs is shown. It is relatively easy to imagine what the common core of all four constructs may be: Persons usually hold and pursue some goals that reflect their personality and self-definition. The behavioral investment in those goals is one aspect of PLI. In contrast, the unique relationships between PLI and personality, current and possible selves, or activities, respectively, are less easy to identify. An aspect that is common to PLI and personality only may be seen in a general tendency to engage with life (including approach and avoidance tendencies). Individual differences in life mechanics may constitute the basis of this differential engagement with life. Individual differences in the tendency to engage with life are not necessarily evident in each and every activity and they are also not necessarily part of a person’s self-definition. PLI and current or possible selves may share some unique content that represents purely cognitive investment in current or possible selves (e.g., planning on how to achieve a possible self, daydreaming about possible selves becoming a reality, or remembering and reflecting on past experiences that are part of the self-definition). A commonality between daily activities and PLI that is unrelated to personality or current and possible selves may lie in everyday routine activities. Those activities are performed on a regular basis by almost everyone irrespective of personal goals or preferences and irrespective of global tendencies to be engaged with life.

Based on Figure 4, a general hypothesis is formulated: *Personality dispositions, current and possible selves, and daily activities are related to average PLI, obligatory PLI, and optional PLI. Current selves, possible selves, and activities, but not personality dispositions, are related to PLI selectivity* (hypothesis 1a). In the following, the reasoning behind this hypothesis is made explicit. The relationships between PLI, self-concept variables, and activities, which provide the basis for the validation of PLI, are elaborated. Based on the similarities and differences between the content measured with PLI and the other constructs a set of more specific hypotheses is derived that spell out hypothesis 1a with regard to individual variables. In addition, differential hypotheses regarding obligatory PLI and optional PLI are formulated.
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Figure 4. Unique and shared overlap of content measured with PLI, personality dispositions, current and possible selves, and daily activities. The size of overlapping portions between the four constructs is not meant to indicate more or less content overlap but merely illustrates that one can expect to find independent and shared portions of content overlap.

a Personal Life Investment and Personality Dispositions

Six personality dispositions are considered in this study: Extraversion, neuroticism, openness to experience, positive affectivity, negative affectivity, and internal control beliefs. In relating goals and personality dispositions, we can identify two major questions. The first concerns the relationship between personality dispositions and goal content. The second concerns the relationship between personality dispositions and goal dimensions, such as investment or absorption, importance, or progress toward the goal. Both issues have been pursued with regard to the Big Five\(^4\) (B. R. Little et al., 1992; Roberts & Robins, 2000; Staudinger & Schindler, 2005).

Extraversion and positive affectivity. On a conceptual and empirical level it has been pointed out that extraversion needs to be partitioned into lower-order traits to understand its development and functionality (e.g., Depue & Collins, 1999; Helson & Kwan, 2000; Roberts, Robins, Caspi, & Trzesniewski, in press; Watson & Clark, 1997). The distinction of two lower-order traits, affiliation and agency, seems most crucial. Affiliation is an interpersonal component and involves

\(^{4}\) The studies by Roberts and Robins (2000) and B. R. Little et al. (1992) included all Big Five traits, that is, agreeableness and conscientiousness in addition to extraversion, neuroticism, and openness. However, agreeableness and conscientiousness were not assessed in the Berlin Aging Study and cannot be employed to validate PLI. Thus, findings concerning these two Big Five traits are not reported and discussed here.
enjoying and valuing close relationships, being gregarious, warm, and affectionate. It reflects successful adaptation through satisfying interpersonal relationships. Agency, in contrast, is a more general disposition that extends beyond the interpersonal realm. It entails adaptation through dominance, ambition, mastery, and achievement (Depue & Collins, 1999; Watson & Clark, 1997).

In a study by Roberts and Robins (2000), high extraversion was associated with economic and political goals. Extraverts strived for goals like high-status careers or political influence, which typically reflect achievement, power, or dominance motives. However, extraverts also reported more goals related to social relationships or hedonistic goals. This simultaneous preference of extraverts for social-relationship goals and achievement and power goals is a reflection of the two components of extraversion.

The behavioral approach system has been identified as the bio-psychological core of the affiliation and agency components of extraversion and positive emotionality (Depue & Collins, 1999; Gray, 1981; Tellegen et al., 1988; Watson & Clark, 1997). Consequently, extraversion and positive affectivity have been proposed as markers of an approach temperament (Elliot & Thrash, 2002). This approach temperament can further be linked to goal engagement, as expressed in the following quotes: “Compared to introverts, extraverts view themselves as more effectively and pleasurably engaged in various aspects of their lives” (Watson & Clark, 1997, p. 788). Surgency or extraversion “is the rate at which energy is expended, more or less regardless of time or place” (D. W. Fiske, 1995, p. 354). On the one hand, a physiologically-based readiness to show approach behavior and experience positive affect may facilitate the initiation and maintenance of goal striving (cf. Kuhl, 2000, 2001). On the other hand, goal striving may more easily lead to positive affective reactions in individuals with a physiological disposition to experience positive affective states. In line with these assumptions, extraversion was found to correlate positively with the goal dimensions of absorption, importance, enjoyment, self-identity, and progress toward the goal (B. R. Little et al., 1992). Average PLI also showed positive associations with extraversion in previous studies (Staudinger & Schindler, 2005; Staudinger et al., 1992; see also Kolbe, 1996). In contrast, PLI selectivity was unrelated to extraversion (Staudinger & Schindler, 2005).

Overall, extraversion and dispositional positive affect, as indicators of an approach temperament, are reflective of a tendency to hold approach goals, expand much energy during goal striving, and experience positive affect during goal striving. Consequently, these indicators of an approach temperament are assumed to be linked with PLI: Positive correlations of extraversion and dispositional positive affectivity with average PLI, obligatory PLI, and optional PLI are predicted. In contrast to the other three PLI facets, this association is not predicted for PLI selectivity. As will be discussed in subsequent chapters, being selective in one’s investments
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is assumed to be primarily a function of available resources (e.g., good health) rather than personality dispositions. This assumption is supported by the above-mentioned study (Staudinger & Schindler, 2005) that did not show any associations between PLI selectivity and personality dispositions across the adult life span. Thus, no association of this kind is predicted (as was already stated in hypothesis 1a).

Neuroticism and negative affectivity. Both neuroticism and negative affect have a biological or mechanistic basis in the behavioral inhibition system (Davidson et al., 2000; Depue & Lenzenweger, 2001; Gray, 1981). The trait of neuroticism involves emotional instability, anxiety, worry, nervousness, and depression. Despite this seemingly negative or dysfunctional character of neuroticism it is expected to positively relate to personal life investment. Some aspects that may be reflected in PLI, such as worrying about goals, experiencing stress during goal pursuit, or rumination after failure to achieve goals, correspond to neuroticism. Accordingly, neuroticism correlated negatively with the goal dimensions of enjoyment, self-identity, perceived control, and progress toward the goal but correlated positively with perceived stress and difficulty (B. R. Little et al., 1992). It has also been suggested that a more reactive behavioral inhibition system (as indicated through high neuroticism or dispositional negative affect) is conducive to the formulation of avoidance goals (Emmons & Kaiser, 1996). At least with regard to self-reports, this association between neuroticism and negative emotionality, as indicative of an avoidance temperament, and the adoption of avoidance goals has been demonstrated (Elliot & Thrash, 2002). As suggested above, obligatory PLI domains sometimes ask for investment that is not felt to be self-congruent but rather caused by external pressure. Moreover, avoidance goals were predicted to occur more frequently within obligatory domains. Those more negative characteristics of obligatory PLI are probably more strongly perceived and responded to by those individuals who have a physiological disposition toward avoidance, that is, who are high on dispositional negative affect and neuroticism. An avoidance tendency should also be conducive to more negative forms of goal striving in obligatory domains, this means, striving that is motivated through avoidance goals and feared selves or problems with the initiation of action and, instead, prolonged phases of rumination and worrying about goals (see also Kuhl, 2000, 2001). It is thus hypothesized that dispositional negative affect and neuroticism both show positive correlations with obligatory PLI. As obligatory PLI is part of average PLI this prediction should also hold for average PLI. And indeed, positive correlations between average PLI and neuroticism have previously been reported (Staudinger & Schindler, 2005; Staudinger et al., 1992; see also Kolbe, 1996). Again, PLI selectivity was found to be unrelated to neuroticism (Staudinger & Schindler, 2005). In contrast to obligatory PLI and average PLI, optional PLI is hypothesized to be unrelated to negative affect and neuroticism.
Based on the interactive effects between individual dispositions (approach and avoidance temperaments) and the opportunities, demands, and barriers of one’s developmental context (as reflected in the distinction between obligatory PLI and optional PLI) a hypothesis is formulated that summarizes the predictions for extraversion/positive affect and neuroticism/negative affect: *Average PLI and obligatory PLI are positively related to both extraversion/positive affectivity and neuroticism/negative affectivity. Optional PLI is positively related to extraversion/positive affectivity but unrelated to neuroticism/negative affectivity* (hypothesis 1b).

*Openness to experience* is expressed in the breadth, depth, and permeability of consciousness. Open individuals have a recurrent need to enlarge and examine experience, are particularly reflective about the ideas they encounter, value philosophical thought, and also tend to revise their attitudes or question existing norms (McCrae, 1996; McCrae & Costa, 1997). This reflection about life in general and one’s life in particular may also explain why open individuals perceive their goals as more self-congruent (B. R. Little et al., 1992). Knowing exactly what one wants and values can facilitate the identification of self-congruent goals, which in turn can enhance motivation for goal pursuit.

Openness has not yet been related to the mechanics of life or approach and avoidance tendencies. Nevertheless, openness shows relations to goal content, goal dimensions, and PLI. People high on openness favored aesthetic goals and personal growth goals, such as writing fiction, producing art, or being well read (Roberts & Robins, 2000). Openness correlated positively with the goal dimensions of enjoyment, value congruency, self-identity, perceived control, and project initiation (B. R. Little et al., 1992) as well as average PLI (Staudinger & Schindler, 2005). Openness was unrelated to PLI selectivity (Staudinger & Schindler, 2005).

People high on openness can be expected to invest much energy in terms of thinking, which is supported by small positive associations between openness and PLI in the domains “life reflection” and “cognitive fitness” (Staudinger & Schindler, 2005). But also across other PLI domains, open individuals can be expected to engage in more “philosophical” thought and hence perceive higher investment in terms of thinking. In addition, the facilitative role of openness for the identification of self-congruent goals and the resulting enhanced motivation may also increase investment in goal pursuit. Consequently, hypothesis 1c states that *openness is positively related to average PLI, obligatory PLI, and optional PLI*.

*Internal control beliefs* and perceived self-efficacy also play a role for goal striving. Control or self-efficacy beliefs are among the most central constructs in research on motivation, self-regulation, or behavior; the relevant literature today is almost too numerous to cite (but see e.g., Ajzen, 1991; Bandura, 1986, 1991; Feather, 1982; H. Heckhausen, 1991; Locke & Latham, 1990).
Engagement with goals is facilitated by self-efficacy beliefs that support efforts to attain the goal (e.g., Feather, 1982; Locke & Latham, 1990; Winell, 1987). In addition, success in goal striving contributes to an increased sense of self-efficacy or internal control potential (e.g., Bandura, 1986, 1991). Thus, it is predicted that internal control beliefs are positively related to average PLI, obligatory PLI, and optional PLI (hypothesis 1d).

An interesting question is whether the correlation between global internal control or self-efficacy beliefs and PLI varies across PLI facets. It has been found that perceived control is not of equal relevance to every kind of behavior (Ajzen, 1991). Obligatory PLI domains have been introduced as necessary for development. This may mean that obligatory PLI is less dependent on perceptions of control or self-efficacy but rather depends on the perceived importance of the domains. Put crudely: If you don’t have a choice, it does not matter whether you believe you can do it. Support for this prediction has been found with regard to avoidance goals. Avoidance goals with a high value or importance turn into a necessity, which means that one must do whatever one can to accomplish the goal, regardless of the ease or likelihood of goal attainment. Empirically, it has been shown that the impact of the expectancy of goal attainment on motivation decreased with an increasing value of the avoidance goal (Higgins, 1997). Moreover, unpublished PLI data that were collected as part of a study on wisdom-related performance in adulthood (Staudinger & Baltes, 1996) support these assumptions about differences between obligatory PLI and optional PLI. In this study, perceived importance of the ten PLI domains and also domain-specific control beliefs were assessed in addition to domain-specific PLI. I selected only the 54 participants who were aged between 60 and 87 years and compared the life domains categorized as obligatory during old age (health, cognition, family, independence, life reflection, death and dying) with those categorized as optional (leisure, friends, sexuality, work). First of all, obligatory life domains, on average, were perceived as more important than optional domains by these older persons (5-point Likert scale: $M_{\text{obligatory}} = 4.08$, $M_{\text{optional}} = 3.66$; $t[53] = 4.07$, $p < .001$). In addition, the average correlation between domain-specific importance and PLI was $r = .57$, $p < .001$, for obligatory domains and $r = .68$, $p < .001$, for optional domains. The average correlation between domain-specific control and PLI was $r = .29$, $p < .05$, for obligatory domains and $r = .60$, $p < .001$, for optional domains. Thus, optional investment was more strongly related to the perceived importance of a specific life domain and the perceived domain-specific control potential than obligatory investment. This supports the conceptualization of obligatory PLI as a “must,” that is, as involving investments that need to be made no matter whether one wishes to or feels in control. Based on these findings it could also be expected to find a higher correlation between global internal control or self-efficacy beliefs and optional PLI as compared to obligatory PLI. However, global control beliefs are not equally strongly related to domain-specific
control beliefs across different life domains (cf. Lachman & Weaver, 1998). Here, it may well be that global control beliefs are more heavily influenced by how well one manages the obligations of life and not so much by how well one manages optional life domains. If global control beliefs of older adults are based on how well they are able to maintain their health, cognitive functioning, and independence it could be expected that investment in these domains is more related to their global control beliefs. As a consequence, obligatory PLI would be more strongly related to internal control beliefs than optional PLI. As theoretical arguments for both higher correlations and lower correlations between internal control beliefs and obligatory PLI as compared to optional PLI can be made, no hypothesis regarding differences between obligatory PLI and optional PLI is derived. Still, it will be interesting to see whether the respective correlations are different.

**b Personal Life Investment and Current and Possible Selves**

Both domain-relevant possible selves and self-definitions may be linked with the perception of high domain-specific personal life investment. People invest energy and effort to achieve future possible selves and they also need to invest energy to demonstrate the adequacy of their present self-definition (cf. C4). However, the correspondence between PLI and current or possible selves is not as close as it may at first seem because there are current and possible selves that do not require energy investment and PLI also comprises activities that are not relevant to current and possible selves. These two reasons are elaborated next. In addition, some methodological considerations seem warranted.

*Some current and possible selves do not require energy investment.* The self-concept contains a large number of different self-related representations. Some of those are directly relevant to behavior, such as recurrent behavioral scripts, self-defining goals, or current social roles. However, the self-concept also comprises self-representations that are currently not relevant for action and thought or do not easily bring about self-defining goals. Past experiences, sociodemographic characteristics, or past roles are important aspects of one’s identity as expressed, for instance, in one’s self-definition or one’s life story (e.g., Freund, 1995; McAdams, 1985). Still, those self-defining characteristics may require little to no energy investment to be maintained as central aspects of one’s self. Consequently, those aspects of the self-definition are not expected to be related to PLI. Similarly, some possible selves merely reflect possibilities in the distant future that are not relevant to present behavior. People may occasionally think about those selves but it seems unlikely that this kind of investment is highly relevant to evaluating one’s engagement with life.
**PLI comprises activities that are not relevant to current and possible selves.** Not everything that we do is directly related to our current or possible selves. People engage in a large number of routine activities and pursue many non-self-defining goals. Those pursuits may require a large share of investment, but they would never come to mind if we are asked to define ourselves or talk about what we hope and fear to be like in the future. The potential of self-representations to distinguish oneself from other people has been identified as one important factor that influences the inclusion of self-representations in the self-definition (e.g., McGuire & McGuire, 1988). This implies that routine activities that are usually performed by everyone are probably not considered as self-defining. Similarly, goals that are presumably held by everyone, such as wanting to be happy, are probably not the first things that come to mind when we report on possible selves.

**Methodological considerations.** In contrast to PLI, current and possible selves are not assessed with standardized Likert-scale measures but with open-ended measures. People are not restricted to a given, predefined pool of items they may or may not consider to be self-defining. Although this open format has a high face-validity and allows people to mention self-defining aspects that are most important to them, it also has some drawbacks. A variety of contextual or situational factors have been shown to influence the self-definition, for instance, the presence of social comparison targets (cf. Kernis & Goldman, 2003; McGuire & McGuire, 1988). The content of the self-definition in old age proved to be rather malleable across a period of eight weeks (Freund, 1995; Freund & Smith, 1999b). This means that a self-definition obtained at any one time does not so much represent all relevant content aspects of the self-definition that are stable over time but rather the part of self-defining knowledge that is accessible and seems relevant at that time, that is, which is part of the working self-concept (e.g., Hannover, 1997; Markus & Wurf, 1987). The fact that a person did not mention self-representations related to one of the ten PLI domains as self-defining does not allow us to conclude that this domain is not self-defining. The domain may be irrelevant to the self-definition, but the person may also have not thought about this domain or may have considered other domains as more relevant at the time of responding. The same argument holds with regard to possible selves: People may mention those possible selves that are accessible and seem most important at the moment. Still, they may also have some hopes or fears in other life domains that were not mentioned. As PLI is measured for a set of predefined life domains, all domains are considered, irrespective of whether they are of high importance to the individual or not. Thus, the different assessment methods may limit the correspondence between PLI and current and possible selves.

In sum, we can expect to see some correspondence between PLI, the self-definition, and possible selves: Many aspects of our self-definitions and many possible selves are involved in
what we think about and do. With data from the Berlin Aging Study, it has been shown that, indeed, the centrality of health-related present and future self-concepts predicted PLI in the health domain (although only 1% of the variance in health PLI was explained; Hauschild, 1996). This relationship was not tested for the remaining PLI domains, however.

The number of self-defining domains and the number of possible selves are of interest with regard to average PLI and PLI selectivity. Higher average PLI is expected in those people who consider more domains as self-defining and/or name more possible selves. Higher PLI selectivity is assumed to relate to a smaller number of self-defining domains and fewer possible selves. The number of self-concepts in obligatory life domains is predicted to be correlated positively with obligatory PLI. The number of self-concepts in optional life domains is predicted to be correlated positively with optional PLI.

The differentiation between hoped-for and feared selves is relevant to the validation of obligatory PLI and optional PLI. Obligatory PLI was introduced as involving avoidance motivation. Thus, one can expect to find a substantial number of feared selves in obligatory life domains. In contrast, feared selves should be almost absent in optional life domains. In line with this assumption, Cross and Markus (1991) found that older adults mentioned no feared possible selves in the (optional) leisure domain, and Frazier, Hooker, Johnson, and Kaus (2000) found that most older participants reported matched hoped-for and feared selves in the obligatory domains of family and physical functioning. Thus, it is predicted that the number of feared possible selves is related to obligatory PLI. As previously mentioned, the conceptualization of obligatory PLI and optional PLI across broad life domains does not rule out the possibility of avoidance goals or feared selves occurring in optional life domains. Nevertheless, a few occasional fears are not expected to be the dominant motivators behind optional PLI and thus the number of fears in optional life domains is probably unrelated to optional PLI.

Two hypotheses summarize the previous considerations. First, it is hypothesized that the number of self-defining domains is positively related to average PLI and negatively related to PLI selectivity. The number of self-definitions in life domains classified as obligatory is positively related to obligatory PLI and the number of self-definitions in life domains classified as optional is positively related to optional PLI (hypothesis 1e). Second, hypothesis 1f states that the number of hoped-for possible selves is positively related to average PLI, obligatory PLI, and optional PLI and negatively related to PLI selectivity. The number of feared possible selves is positively related to average PLI and obligatory PLI, negatively related to PLI selectivity, and unrelated to obligatory PLI. Similarly, the numbers of both hoped-for and feared selves in life domains classified as obligatory are positively related to obligatory PLI but only the number of hoped-for selves in life domains classified as optional is positively related to optional PLI.
c  Personal Life Investment and Activities

Can personal life investment data be related to engagement in specific daily activities? When we speak of daily activities, we usually mean the observable part of an action. As discussed in C3, however, there is much more to action than observable behavior. Consequently, personal life investment aims at assessing all parts of an action rather than merely overt behavior, that is, goal selection, preparatory thought, and maintenance of intentions in addition to overt goal pursuit. This conceptual difference between daily activities and personal life investment limits the correspondence possible between the frequency of activity engagement and PLI reports. Specifically, three theoretical arguments can be made as to why this should be the case: First, daily activities include actions that are not reflected in PLI. Second, PLI involves engagement in goals that may never spur activity. And third, there is no rule as to which activities do and do not pertain to a specific PLI domain. In addition, some methodological considerations are of interest.

Daily activities include actions that are not reflected in PLI. Action-theoretical approaches often highlight unconscious or automatic components of actions. And indeed, automaticity plays a pervasive role in everyday life (Bargh, 1990, 1997; Brandstädter, 2001). Environmental events can directly activate cognitive, affective, and motivational processes that operate and run to completion without conscious intention or awareness (Bargh, 1997). The effortless processes involved in automatic goal pursuit function with almost no attention paid to them. As a consequence, someone who is asked about what he or she has been doing throughout the day or even the last months would most likely not come up with recollections of automatic goal pursuit.

PLI involves engagement in goals that may never spur activity. The main problem with the relation between goals and actions is not that automatic actions do not require conscious goals to be performed but rather that some conscious goals never lead to action. As mentioned above, there is a long path from wishes to action and some wishes never lead to actions but become “trapped” along the way (H. Heckhausen & Kuhl, 1985). Those trapped wishes may serve an adaptive motivational function if they do not require consciousness or attention to be maintained in case information is encountered that points to a possibility of overcoming the obstacles in the developmental path of the wish. Here, wishes can be imagined as “put on the shelf.” They usually capture our attention only if nothing else of importance is being done and thus do not interfere with action. Trapped wishes may figure prominently in our daydreams, wishful thinking, or positive fantasies (cf. H. Heckhausen & Kuhl, 1985; Oettingen, 1996). In contrast, other trapped wishes can become dysfunctional if they take up working memory capacity and reduce the efficiency of other cognitive activities that may serve to pursue other wishes or goals. Here,
people ruminate or worry about things they cannot accomplish instead of striving for goals they can achieve.

In judging how much thought and effort is put into a specific life domain investment in the form of both frequent daydreaming and preoccupation with goals one cannot accomplish may foster perceptions of increased thinking time devoted to this domain. As those kinds of PLI usually do not result in overt action, they can be considered a source of incongruence between PLI ratings and observed daily activities: PLI assesses actions and thoughts, whereas daily activities primarily assess overt actions.

There is no rule as to which activities do and do not pertain to a specific PLI domain. When we observe an individual’s behavior we can usually tell readily whether this behavior is performed at will, that is, whether it is an action. For instance, we have no problem in differentiating between someone walking down the stairs as part of the action of going somewhere and someone accidentally falling down the stairs. Nevertheless, a problem arises once we try to identify the intention behind an overt activity without asking the person. If we have no additional information, it is impossible to determine whether someone walks down the stairs in an office building in order to get a cup of coffee or in order to talk to a colleague. The situation becomes even more complicated if we want to relate this activity to a person’s high-level goals. Is the action of walking down the stairs related to the superordinate goal of excelling at the job or to the goal of taking frequent breaks and expressing a couldn’t-care-less attitude toward work?

It is usually problematic to interpret the mere description of an action, that is, to identify the underlying goal or meaning (cf. Read, Druian, & Miller, 1989; Robinson, 1977; von Cranach et al., 1982; Werbik, 1978). To account for the inadequacy of objective properties of action for the study of personal goals, participants are often asked to relate their everyday actions to their personal goals themselves (e.g., Cantor & Fleeson, 1991; Emmons & Diener, 1986; Winell, 1987). If we do not know the personal meaning of an activity, however, we need to rely on theoretical approaches to the identification of the most likely meaning. Here, we need to take into account the multifinality or polyvalence of action (Boesch, 1991; Brandstädter, 1998; Shah & Kruglanski, 2000; cf. C3), that is, the fact that an action usually serves multiple goals or is related to several life domains. It seems unlikely that actions pertain to only one PLI domain. Whenever researchers try to categorize activities as indicative of goal domains they have to deal with this ambiguity and accept that it is not possible to identify all goals that may have been relevant to that activity. Thus, on the one hand, the researcher’s lack of knowledge regarding the goals of an individual may lead to the misclassification of activities.

On the other hand, participants may differ in the kinds of activities or goals they consider as relevant when they are asked to judge their investment in life domains like independence or
occupation-like activities. And these interpretations may also differ from what the researcher has in mind when talking about the respective life domains. Here, we need to consider processes of redefinition (cf. Hacker, 1985b; Hacker & Wetzstein, 2003). In a global sense, redefinition means that people need to interpret their social world and that people differ in their perceptions and interpretations. Two types of processes relevant to redefinition, translation and reinterpretation, which were identified in action regulation theory (Hacker & Wetzstein, 2003), can also be applied to this global concept of redefinition. In translation-type processes of redefinition the originally intended meaning is preserved. In contrast, reinterpretation-type processes of redefinition can lead to deviations from the intended meaning. Especially abstract or vague formulations encourage reinterpretation. The individual first needs to specify what the meaning actually is. The assigned meanings may be unsatisfactory when compared to what was originally intended.

Redefinition occurs when people need to implicitly or explicitly categorize their idiosyncratic goals or activities with respect to specified goal categories, as is sometimes required in research on personal goals (e.g., Brandstädter & Baltes-Götz, 1990; Cantor & Fleeson, 1991; Staudinger et al., 1999). Hence, whenever we speak to a person about an action category or goal domain, we need to consider that processes of redefinition occur that may be highly idiosyncratic. Here, it is beneficial to have some idea about the meaning of a goal domain that the population under study most likely attaches to it. The redefinition of the domain “independence,” for instance, becomes clearer if we consider the meaning that older people attach to the term “independence” or “autonomy” (Schmid-Furstoss, 1990).

Methodological considerations. In addition to the aforementioned conceptual differences, there is also a large difference between the methods applied in PLI and activity assessment. PLI is measured via questionnaire (Staudinger et al., 1999; Staudinger et al., 1992) and daily activities are assessed with experience sampling methods (e.g., Klumb, 2001; Klumb & Baltes, 1999b) or interviews (e.g., Yesterday Interview; Moss & Lawton, 1982). A person can only engage in and hence report a limited number of activities at a time (often just one), whereas the assessment of personal life investment allows for repeated employment of the highest possible score on the rating scale. Nevertheless, an identical rating across several PLI domains does not mean that an equal amount of time is spent engaging in activities relevant to each domain. Rather, the judgments people make usually involve some kind of comparison process, such as social or temporal comparisons (e.g., Gibbons & Buunk, 1999; Schwarz & Strack, 1999). It can be assumed that people consider such factors as how much other people (generalized or specific) invest in specific life domains, or how much they ought to invest, would ideally like to invest, or invested in the past. Thus, depending on the PLI domain, a high domain-specific PLI rating may imply quite different amounts of time and effort actually invested.
In addition, there remain some other limiting factors on the correspondence between PLI and activities. One is the different time frames that are considered when measuring PLI and activities. PLI is usually assessed for longer time spans or as a person’s typical domain-specific investment level, whereas activities are assessed during a limited number of days or weeks. This sample of activities does not necessarily provide a good representation of behavior in general. Specifically, opportunity structures of the days of the week differ, providing opportunities for some activities but limiting other activities (cf. Cantor & Fleeson, 1991). For instance, people usually go to church on Sundays but not on Mondays or Wednesdays. People go to see their doctors on weekdays but not on weekends. In order to get some idea about the spectrum of activities performed by each person, it is thus beneficial to at least know their activities for one entire week. However, the same rationale applies to opportunity structures provided by different weeks or months, for instance, people can be expected to engage in gardening more frequently during March than during January. Interviewing people on their activities on different days or in different months can create interindividual differences that are not attributable to characteristics of the interviewees.

But even if detailed information regarding the activities during the last months was available and people were simply to report on these activities, the correspondence between actual and remembered activities would be far from perfect (cf. Klumb & Baltes, 1999b; Niemi, 1993; Shiffman et al., 1997). It has been shown that people tend to report more activities than they have actually performed, especially for socially desirable activities (Niemi, 1993). When the activities of one day are measured with an experience-sampling method and are compared to the activities reported during a retrospective interview conducted on the following day, considerable, but not perfect, agreement between the two methods has been found (Klumb & Baltes, 1999b).

An initial study on the relationship between PLI and activities including 75 participants of the Berlin Aging Study (Hornig, 2003) showed that the correspondence between PLI ratings and daily activities assessed via experience sampling during one week of a diary study (cf. Klumb, 2001; Klumb & Baltes, 1999b) is indeed limited. Participants who engaged in more activities with or for friends or in the occupational domain reported higher personal life investment in the domains “friends” or “occupation,” respectively. Probably, there is a high social consensus on which activities have to do with friends or occupation. And also, the meaning of those domains is quite concrete (as compared to “independence” or “thinking about life”). Talking about friends and occupation probably does not invite highly idiosyncratic redefinitions. For the seven remaining PLI domains, no significant relations between PLI and percentage frequency of activity engagement were found, although correlations tended to be in the positive direction (Hornig, 2003). In addition, first hints on a moderating role of participants’ age and health status
on the relation between PLI and daily activities were found. The initial findings on the moderating role of age were followed up as part of the validation of PLI ratings in the present study, which involves a much larger and more heterogeneous sample.

In sum, what is measured with PLI data and activity data is quite different and there are also large differences as to how this is measured. Nevertheless, there is a theoretical link between PLI and activity. Frequent engagement in domain-relevant activities is one factor—among other factors—that is conducive to a high domain-specific PLI rating. Thus, the correlations between domain-specific PLI ratings and the duration of activity engagement are expected to be small but existent. Turning to the more general facets of PLI and activity engagement may facilitate the demonstration of associations. The overall duration of activity during one day is indicative of the length of the waking day of a person. Being active for longer time periods, that is, having a longer waking day, may lead to more perceived average PLI. Similarly, being more active in obligatory life domains may increase average obligatory PLI and being more active in optional life domains may increase optional PLI. Having less time available, that is, diminished overall activity, is predicted to be positively related to PLI selectivity. Hypothesis 1g thus states that the total duration of activity is positively related to average PLI and negatively related to PLI selectivity. Performing more activities classified as obligatory is positively related to obligatory PLI and performing more activities classified as optional is positively related to optional PLI.
LATE-LIFE DEVELOPMENT OF LIFE COMPOSITION

So far, the functional role of personal life investment within the pragmatic self-system has been discussed. The evidence cited was drawn from studies spanning the entire adult age range. As many of the studies have been conducted with young to middle-aged adults (or college students), not all results may generalize to old and very old people. The following sections concentrate on the last phase of the life span and introduce findings that are specific to this life phase. As previously mentioned, the data employed in this study were collected as part of the Berlin Aging Study (BASE; for overviews see P. B. Baltes & Mayer, 1999; P. B. Baltes & Smith, 1997; Smith, Maas et al., 2002). A large number of studies that made use of the (cross-sectional) BASE data set have already been published. This means that many of the findings on late-life development to be reported have been obtained with the sample of people studied here.

As a first step, let me introduce the last phase of the life span in general terms. The global developmental context of old and very old people and also age-typical developmental changes in the ten PLI domains are briefly described. Then, age-related changes in older people's ways of engaging with life, that is, their goals, self-concepts, and activities are discussed. In order to derive hypotheses on the late-life development of the four PLI facets it is also necessary to address some peculiarities of longitudinal research with older people. Those are discussed in a short excursus before a second set of hypotheses is formulated.

1 Characteristics of Development in Old and Very Old Age

On a very global level, central characteristics of late-life development can be described with two statements. First of all, we should keep in mind that “the elderly” do not exist. In many respects, the group of people referred to as the elderly is even more heterogeneous than groups of young or middle-aged adults. Second, there are different kinds of developmental influences and their prevalence changes across the life span. Both statements shall now be elaborated.

Heterogeneity of old people. Increased interindividual variability during old age has been documented with regard to psychological functioning (e.g., Christensen et al., 1999; Hagberg, Alfredson, Poon, & Homma, 2001; Morse, 1993; Nelson & Dannefer, 1992) and also physical functioning (e.g., Folkow & Svanborg, 1993; Shafiq-Antonacci et al., 1999)—although it should be noted that not all studies support this picture (e.g., Salthouse, 2004). One source of greater differences between people with increasing age can be seen in the cumulative effects of individual life experiences and opportunities to select and shape environments in accordance with one’s genotype and preferences (cf. Dannefer, 1987; Morse, 1993; Nelson & Dannefer, 1992). Further,
differential speed of decline in psychological or physical functioning (i.e., differential intra-
individual change; Nesselroade, 1991) increases interindividual variability. Finally, the fact that
people become more variable in their performance with increasing age (i.e., increased intra-
individual variability; cf. S.-C. Li, Aggen, Nesselroade, & Baltes, 2001; Rabbitt, Osman, Moore, &
Stollery, 2001; Salthouse, 1993) can contribute to greater heterogeneity observed among older
people (cf. S.-C. Li & Lindenberger, 1999; Molenaar, Huizenga, & Nesselroade, 2003; Nesselroade,
1991). Here however, we need to consider that intraindividual variability does not
increase across all domains of functioning during old age. Rather, higher variability has been
observed in cognitive and sensorimotor functioning but reduced variability was evident in
affective functioning (S.-C. Li, Smith, & Lindenberger, 2004). Thus, increased interindividual and
intraindividual variability in older adults is evident only in some psychological and physical
functions but not a universal effect. Still, the assumption that old people are highly similar or
become more alike with increasing age is clearly not warranted. Old and very old people can
develop in dissimilar ways and these interindividual differences need to be addressed in addition
to average developmental trends.

We also need to consider that “old age” refers to the age range between approximately 60
years to over 100 years. Those 40 years cannot be studied and described as just one phase of life
but rather require further differentiation. The distinction between the third and fourth age or the
young old and old old is of crucial importance to understand and integrate gerontological
findings (M. M. Baltes, 1998; P. B. Baltes, 1997; P. B. Baltes & Smith, 1999, 2003; C. L. Johnson,
1994; Laslett, 1991; Neugarten, 1974/1996a). The third age (up to approximately age 80 – 85) has
been characterized as a period of life when people show some declines in cognitive and physical
functioning but, nevertheless, are able to protect their sense of well-being and satisfaction with
life. Those people have the potential for being effective and productive members of society (e.g.,
P. B. Baltes & Smith, 2003; Staudinger & Schindler, 2002). In contrast, the fourth age (above 80 –
85 years) is not a simple continuation of the third age. It represents the incompleteness of the
biological and cultural architecture of the human life span in its most radical form and hence the
limits of successful aging (P. B. Baltes, 1997). The fourth age is characterized by increased dys-
functionality and disability and diminished life quality (P. B. Baltes, 1997; P. B. Baltes & Smith,
1999, 2003; C. L. Johnson, 1994; Smith & Baltes, 1997; Smith & Delius, 2003). Still, the fourth
age is not nearly as closely linked to chronological age as this description suggests. Rather, the
onset and experience of the fourth age may vary considerably on the individual level (cf. P. B.
Baltes & Smith, 2003).

The increasing interest in centenarians further gave rise to new questions concerning the
nature of the fourth age. Specifically, the general description of the fourth age in terms of de-
clining levels of functioning and increasing interindividual variability in functioning may or may not hold true for those people who will become centenarians. Two perspectives on developmental trajectories of average levels of functioning that are associated with extreme longevity can be differentiated (Rott, d'Heureuse, Kliegel, Schönemann, & Becker, 2001). In the more negative perspective, extreme longevity is associated with prolonged aging processes that have many negative consequences but do not lead to death. In the more positive perspective, centenarians, as an extremely positive selection of their birth cohort, are expected to function on relatively high levels. Empirical findings point to a mixture of both processes, with some of the oldest old being more readily characterized by prolonged aging processes and others being more readily characterized as showing only minimal impairments up to age 90 or even 100 years (Andersen-Ranberg, Vasegaard, & Jeune, 2001; Evert, Lawler, Bogan, & Perls, 2003; Finch, 1998; P. Martin, Poon, Kim, & Johnson, 1996; Rott et al. 2001; Smith & Baltes, 1997). Moreover, no general increase or decline in interindividual variability in centenarians has been observed. Rather, there are domains where centenarians demonstrated greater variability than sexagenarians or octogenarians but also domains where centenarians were less variable (P. Martin, 1997).

On a population level, the overall negative developmental trends that can be observed with the beginning of the fourth age for the majority of the population may become increasingly mixed with the more positive developmental trends of some extremely long-lived people. Average development during the ninth and tenth decade of life may appear less negative compared to average development during the eighth decade of life if more and more people with extremely negative developmental trends die and more and more people with extremely positive developmental trends survive. As a consequence of this shifting population composition due to survivor effects (e.g., Nesselroade & Labouvie, 1985; Sliwinski, Hofer, Hall, Buschke, & Lipton, 2003; Vaupel & Yashin, 1985) diminished or even no further age-related losses may be observable on the population level beginning at a certain age, perhaps around age 90.

From these considerations, two conclusions can be drawn that are relevant to the present study. First, variability in developmental trajectories needs to be studied in addition to average developmental trends. And second, what the average developmental trend looks like depends on the selection of persons in a study (see also D4). A sample including a high proportion of extremely long-lived people will yield different average trajectories compared to a representative sample.

Developmental influences. After having emphasized the heterogeneity of the aged population, I now want to summarize some general considerations on the nature of old age (P. B. Baltes, 1997; P. B. Baltes, Cornelius, & Nesselroade, 1979; P. B. Baltes et al., 1998; P. B. Baltes, Reese, & Lipsitt, 1980; Staudinger et al., 1993, 1995). In addition to the active role of the individual as
producer of his or her development (e.g., Brandtstädter, 1998; Brandtstädter & Lerner, 1999; Lerner & Busch-Rossnagel, 1981), three major developmental influences have been identified: Normative age-graded influences, normative history-graded influences, and non-normative influences (P. B. Baltes et al., 1998; P. B. Baltes et al., 1979; P. B. Baltes et al., 1980). Age-graded influences on development are those biological and environmental aspects that have a strong relationship with chronological age (e.g., biological maturation, age-graded socialization events). They occur in highly similar ways for all people of a given age. History-graded influences are defined as those biological and environmental aspects that lead to differences in ontogenetic development across historical time (e.g., war, economic depression, modernization). Those influences have a highly similar impact on all members of a given cohort. Non-normative or idiosyncratic influences on development are those biological and environmental events that do not normatively occur for most individuals but still have a strong influence on individual development (e.g., accidents, death of relatives, life-threatening diseases). Throughout the lifespan, the three influences are closely intertwined and exert a joint impact on the developing individual, who in turn mediates these impacts through his or her actions and reactions. However, age-graded, history-graded, and non-normative influences are not equally strong during all phases of the life span. A heuristic model of the lifespan trajectories of the relative impact of each of the three influences on development is depicted in Figure 5 (left panel; P. B. Baltes et al., 1979; P. B. Baltes et al., 1980). The dominant influences on late-life development are non-normative life events, followed by age-graded life events. History-graded life events play only a minor role in terms of their relative strength of influence on development.

One may draw the somewhat paradoxical conclusion that non-normative life events are normative occurrences during old age, although the specific events differ across people. The dominance of non-normative and, to a lesser degree, age-graded influences can be understood on the background of the general architecture of the lifespan dynamics between biology and culture (P. B. Baltes, 1997; P. B. Baltes et al., 1998). Because the majority of people reaching advanced old age is, historically speaking, a recent phenomenon, there is no tradition of biological and cultural co-evolution for this phase of life. Evolutionary selection pressure has operated primarily during the first half of life (i.e., prior to reproduction) and thus has neglected dysfunctional genetic expressions during old age, which cause non-normative life events like dementia or severe illness. Evolutionary selection benefits are reflected in the dominance of normative age-graded influences on childhood development, where genes control biological maturation. This beneficial effect of evolution-based genetic control declines with increasing age. The increase in age-graded developmental influences during old age can be related to a biological program of increasing dysfunction and, eventually, death. Thus, the biological processes operating during old age most
likely do not reflect evolutionary selection benefits (but see Mergler & Goldstein, 1983 for an alternative view).

Figure 5. Shifting relative impact and valence of developmental influences. Old age is characterized by increases in non-normative and age-graded influences on development (left panel; after P. B. Baltes et al., 1980). As those influences are primarily of negative valence an increasing share of available resources needs to be invested in maintenance of functioning and coping with loss (right panel; after Staudinger et al., 1993, 1995).

With the increasing dominance of non-normative and age-graded effects on development the valence of developmental impacts also changes. Non-normative and age-graded influences during old age are predominantly of negative valence, that is, events like bereavement, terminal illness, declining cognitive functioning, and increasing levels of disability. Consequently, the allocation of available resources changes from a focus on growth and developmental gain to a focus on maintenance of functioning and regulation of loss (right panel Figure 5; Staudinger et al., 1993, 1995).

Overall, different types of processes (age-graded, history-graded, and non-normative) can influence development in old and very old age. In general, non-normative and age-graded influences become more influential during late life and are accompanied by systematic changes in resource allocation. These changes in developmental influences and resource allocation are also reflected in domain-specific developmental change or changes in the motivational expression during old age, which are discussed in the following sections.

2 A Short Characterization of Developmental Change in Ten Central Life Domains

Late-life changes in the ten life domains that are considered in the PLI Schedule will now be briefly characterized. Older people’s perceptions of the amount of energy and effort invested in the ten domains can only be understood against the background of age-related characteristics
of those domains and domain-specific developmental change. First, the goal domains classified as obligatory, that is, health, cognitive fitness, independence, life reflection, death and dying, and family, are introduced. After that, the optional goal domains, that is, friends, sexuality, occupation, and leisure, are described.

Because a wealth of findings and theories exists with regard to each of the ten life domains the aim of the following sections is not to represent the current state of affairs in the respective research areas (that would not be feasible within this dissertation). Rather, fairly general descriptions of late-life development in the ten domains are offered. In addition to some research findings, the developmental tasks (Havighurst, 1956, 1972) of older people are considered to characterize what is central in each domain.

Every society provides some culturally shared knowledge about which goals or tasks an individual of a given age should pursue to increase and maintain adaptive capacity. Those normative expectations are reflected in the concept of developmental task (Havighurst, 1956, 1972), which is a task that each person has to face during a certain period in his or her life, successful mastery of which leads to satisfaction and happiness, and promotes success with subsequent tasks, whereas failure leads to unhappiness and disapproval by the society, and endangers further progress and mastery of later tasks. Developmental tasks as age-normative challenges to individual development arise from physical maturation, the cultural pressure of society, and personal values and aspirations (Havighurst, 1956, 1972). As the tasks dictated by cultural demands and social norms are by no means arbitrary sets but rather reflect the wisdom and historical experience of a culture, those normative developmental goals help constrain developmental options and assist in selecting goals in order to make optimal use of age-graded opportunity structures (Cantor & Fleeson, 1991; Freund, 2003; Freund & Baltes, in press; J. Heckhausen, 1990, 1999; Oerter, 1986).

Research on social expectations has demonstrated that there is a high degree of consensus on the appropriate age and timing for pursuing developmental tasks or completing developmental transitions (Neugarten, Moore, & Lowe, 1968; Settersten & Hagestad, 1996a, b; Settersten, 1997). And, not surprisingly, developmental tasks are adopted as personal goals, that is, goals and goal investment reflect the demands, challenges, and age-normative tasks typical of a specific age range and developmental context (Cantor & Langston, 1989; Nurmi, 1992, 1993; Staudinger & Pasupathi, 2000; Staudinger & Schindler, 2005). However, age-normative expectations should not be mistaken for “ought” rules that are associated with social sanctions in case of transgressions. Rather, they serve as guidelines for individual life composition, that is, internalized standards for what constitutes normal, expectable development (Freund, 2003; Freund & Baltes, in press; J. Heckhausen, 1990; Nurmi, 1992).
With regard to the developmental tasks of old age, three proposals seem most prominent:5 The work of Havighurst (1972), Erikson (1959; Erikson et al., 1986), and Peck (1956). The tasks proposed by each of these three researchers are considered in the description of late-life development in the ten life domains.

**Health.** Deteriorating health is one of the first associations that comes to mind when we think about old age. Adapting to decreasing physical strength and health without becoming preoccupied with one’s physical decline figures prominently among the developmental tasks of old age (Havighurst, 1972; Peck, 1956). Physiological changes that lead to progressive structural and functional decrements in all tissues and organs and increased vulnerability to chronic and acute illnesses are characteristic of aging (for overviews see Jette, 1996; Masoro & Austad, 2001; Steinhagen-Thiessen & Borchelt, 1999; Steinhagen-Thiessen, Gerok, & Borchelt, 1994). Aging is accompanied by increasing functional impairments in all of the senses, that is, vision, hearing, taste, smell, and also vestibular and cutaneous senses. The prevalence of frailty and disability, that is, generalized weakness, impaired mobility and balance, poor endurance, and loss of muscle strength, increases in old age. An increasing number of diseases and multimorbidity, that is, the accumulation of chronic conditions and diseases, are also characteristic. Among the most prevalent diseases beyond the age of 70 are cardiovascular diseases and arthritis. Specific physical illnesses, such as stroke, coronary heart disease, or osteoarthritis, are also related to more functional limitations. Overall, the physiological changes accompanying aging result in reduced functional health and increased vulnerability to chronic and acute illnesses. The detrimental effects of physiological aging become particularly pronounced during the fourth age. Paralleling changes in objective health, subjective health also declines during old age. This decline is stronger in old-old people than in young-old people (Pinquart, 2001b).

Functional health can be considered as crucial to activity and goal striving. Impaired vision and hearing, loss of balance and mobility, and loss of muscle strength directly limit independent activity and increase the need for help. Illnesses have an impact on independent living only insofar as they are associated with functional impairments.

**Cognitive fitness.** Adapting to cognitive change is usually not formulated as a separate developmental task but rather seems to be incorporated in the task of adjusting to diminishing health. Still, cognitive decline clearly is something that older adults need to deal with. Cognitive change during old age is most easily described for two main components of intellectual functioning: Cognitive mechanics, that is, the neurophysiological architecture of the mind as

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5 Erikson and Peck do not use the term “developmental task.” Nevertheless, there is sufficient overlap between their concepts and the concept of developmental task to allow for a comparison and integration. All concepts are concerned with mastering age-related developmental challenges and opportunities.
indexed by the speed, accuracy, and coordination of elementary processing operations, and
cognitive pragmatics, that is, available bodies of declarative and procedural knowledge (for
overviews see P. B. Baltes et al., 1998; P. B. Baltes, Staudinger, & Lindenberger, 1999; Linden-
berger & Reischies, 1999; Singer, Verhaeghen, Ghisletta, Lindenberger, & Baltes, 2003). Cogni-
tive mechanics start to decline already in young adulthood and continue to decline throughout
the remaining life span. Cognitive pragmatics, in contrast, are maintained on a high level until old
age. During old age, however, the pragmatics also start to decline. Very old age is associated with
more rapid declines in both mechanics and pragmatics. It also needs to be considered that cognitive mechanics and pragmatics are intertwined in
many ways (e.g., Ghisletta & Lindenberger, 2003). For instance, pragmatic knowledge helps to
compensate for age-related losses in mechanics and maintain functioning on a high level as long
as a certain minimum level of mechanic functioning is preserved. Here again, very old age is
associated with levels of mechanic functioning that are sufficiently low to impair intellectual
functioning in a relatively global manner. This is indicated by the rapid decline in pragmatics and
cognitive dedifferentiation, that is, increasing intercorrelations both between and within mechanic
and pragmatic abilities. Moreover, intellectual performance shows plasticity throughout life, but
age-based losses lead to a reduction in the amount of plasticity with increasing age. Cognitive
plasticity is severely reduced, but still evident, during the fourth age (Singer, Lindenberger, &
Baltes, 2003).

In addition, we also need to take into consideration pathological change in cognitive
functioning during old age. Dementia is the most frequent psychiatric illness among the elderly.
In BASE, no cases of dementia were found below the age of 75. In contrast, about 40% of the
participants over 90 years were affected (Helmchen et al., 1999). Dementia also has consequences
for everyday functioning. In demented individuals a decrease in instrumental or practical activi-
ties, a doubling of sleep and rest phases, and a reduction of time spent outdoors was observed.

**Independence.** During old age, functional impairments limit one’s everyday competence and
hence one’s ability to live independently (M. M. Baltes, Maas, Wilms, Borchelt, & Little, 1999; M.
M. Baltes, Mayr, Borchelt, Maas, & Wilms, 1993). The need for care increases during old age.
While only 8% – 9% of 75- to 79-year-olds require assistance with basic activities of daily living,
about 40% of persons over 85 years are in need of care (BMFSF, 2001). Consequently, trying
to maintain independent living was included among the tasks of old age (Erikson, 1959;
Havighurst, 1972). For instance, Erikson stressed that older people need to accept limits to the
expression of independence, initiative, or willfulness and simultaneously remain independent and
active as far as possible (Erikson et al., 1986).
Nevertheless, the meaning of independence for older adults cannot be reduced to not being frail and physically dependent. Rather, independence is a multidimensional concept and includes, for instance, aspects of functional, cognitive, economic, and social independence. In a study on lay conceptions of independence among elderly women, Schmid-Furstoss (1990) found that being able to independently perform basic everyday activities was perceived as a source of competence, which in turn was associated with higher perceived independence. Especially among frail women functional limitations and loss of physical strength were seen as central to dependence. However, old women in better health defined independence also in terms of personality dispositions (e.g., not being passive, self-reliance, self-efficacy beliefs, optimistic attitude toward life) and being able to make one’s own decisions and act accordingly. Dependence was conceptualized as resulting from cognitive limitations, such as lack of knowledge or inability to solve problems in everyday life. Thus, an understanding of independence as autonomy, that is, perceiving oneself as the causal agent behind one’s decisions and actions rather than being told by others what to do, is not limited to earlier phases of the life span.

Life reflection. One aspect of life reflection, the life review, has been identified as particularly important during old age. Reviewing their lives helps older individuals to deal with the growing awareness of approaching death and to come to terms with their lives as lived (Butler, 1974; Erikson, 1959; Erikson et al., 1986). However, the more general process of life reflection is central for life composition at all ages. In order to shape one’s development in accordance with one’s goals and preferences but also to adapt to developmental limitations, one needs to be aware of one’s goals and preferences, devise plans for how to achieve them (cf. Smith, 1996, 1999), and learn to accept failure and missed chances. Life reflection is an important part of all those activities. Accordingly, the frequency of thinking about one’s life was found to be stable on a high level across the adult age range or to even slightly increase very late in life (Staudinger, 2001; Staudinger & Schindler, 2005). Still, the specific functions of life reflection, together with the relevant goals and preferences, change with increasing age. Older people were engaging in life reflection to draw a life balance and integrate their life as lived rather than to gain more insight into who they are or make important life decisions, which was common among younger adults (Staudinger, 2001). Older adults also reported thinking more about their lives in order to teach and inform others and share their accumulated life experience (Webster, 1993). As long as older adults do not suffer from severe dementia or mental disorders, the ability to reflect about one’s life is probably among the best preserved abilities in late life.
Death and dying. For old and very old people death is not a distant fate any more but rather something to be expected quite soon. The deaths of spouses, friends, siblings, and other social partners further confront the elderly with the finitude of existence. Accepting death, transcending the individual self, and working to perpetuate the self after one’s death were identified as developmental tasks (Erikson et al., 1986; Peck, 1956). In general, older adults seem to cope with this situation quite well, as indicated through a higher amount of thinking devoted to death preparation (Webster, 1993) and a better acceptance of death, that is, the absence of fear and anxiety about death (L. D. Nelson, 1979; Reker, Peacock, & Wong, 1987). Old persons more often than younger persons perceive death as a release. Furthermore, preparation for death in terms of concrete activities (e.g., talking to others about death, having planned one’s estate, signed a will, or made preparations for one’s funeral) becomes more prevalent with increasing age (Pinquart & Sörensen, 2002). However, there are large interindividual differences in coping with death and dying (for overviews see Kruse & Schmitt, 2001; Pinquart & Sörensen, 2002; Schmutz-Scherzer, 1994). Religious activities can be helpful in coping with dying and lower the fear of death. Religious people are also more likely to actively prepare for their deaths. More time devoted to thinking about death in general, however, is not beneficial to older persons but is rather positively related to the manifestation of depressive symptoms. Consequently, denial of thinking about one’s death has also been identified as a widely used mode of coping with death anxiety and mortality (Stillion, 1995).

Family. Kahn and Antonucci (1980) coined the metaphor of “social convoys” to depict that people, throughout their entire lives, are surrounded by a network of social partners who influence them in both positive and negative ways. Those social convoys undergo age-related changes across the life span. Family relations have figured prominently in research on the number, nature, and functions of social relationships in old age and age-associated changes in social relationships (for overviews see Antonucci, 2001; Lang, 2000; Lang & Carstensen, 1998; Wagner, Schütze, & Lang, 1999). There is a general developmental trend to shift one’s attention to those interaction partners to whom one feels closest with increasing age or less remaining life time (e.g., Carstensen, 1993; Carstensen, Isaacowitz, & Charles, 1999). As most people report immediate family as their closest relationships, family ties still gain in importance during old age. Old people who felt near to death were found to increase emotional closeness with family members (Lang, 2000). Family members also play a crucial role in providing older persons with instrumental and emotional support and affectionate exchanges. The amount of received instrumental and emotional support clearly increases during old age. Still, even the oldest old continue to offer instrumental or emotional support to other persons, mostly family members. This may
be considered as one expression of generativity, another developmental task of old age (Eriskon, 1959; Erikson et al., 1986; Peck, 1956).

Nevertheless, opportunities to benefit from family relations are somewhat unevenly distributed among the elderly. Very old persons and women are much less likely to be still married than younger old persons and men. With increasing age the probability of outliving siblings and even children also increases. These changes in social network composition have an impact on exchanged support and affection. Older people with children were found to receive more help and affection than childless older people. Married people did not receive more help or exchange more affection than widowed or single people, but they provided more help for others (Wagner et al., 1999).

**Friends and acquaintances.** Relationships with friends and acquaintances are also frequently considered in the literature on changes in the composition and functions of social networks during old age (for overviews see Antonucci, 2001; Lang, 2000; Lang & Carstensen, 1998; Wagner et al., 1999). The total number of social network partners decreases with age. This decline is mostly due to ending relationships with acquaintances or less close friends, while relationships to one’s closest social companions are maintained and even increase in closeness. However, as one reaches 80, 90, or even 100 years, significantly fewer people who have been close supporters are still alive. Other barriers to friendship contact in late life are one’s own or the friend’s illness and frailty or relocation. In BASE, about 70% of the participants under 85 years reported to have at least one friend, but only 43% of those aged 85 and over did so (Wagner et al., 1999). Opportunities for contact with friends thus diminish with increasing age. Maintaining contact with friends has not been considered when proposing developmental tasks of old age. However, friends may assist in mastering developmental tasks or serve as role models.

**Sexuality.** The frequency of sexual activity decreases with age (for overviews see Furchtgott, 1999; Rosenmayr, 1994) and sexuality clearly is *not* a development task of old age. Nevertheless, one needs to be careful not to think of the elderly as “asexual.” A number of septua-, octo- and nonagenarians, and even some centenarians, still engage in and enjoy several types of sexual behaviors, such as sexual intercourse, masturbation, touching and caressing, or sexual fantasies. Age-associated changes in other life domains, for instance, poor physical health or loss of one’s partner, constitute limiting factors for sexual activity. A number of medical conditions that frequently occur in older persons (e.g., diabetes mellitus, cardiovascular diseases) and some of the drugs prescribed for several ailments will reduce sexual functions, especially in men. Opportunities for sexual contact are sharply reduced in widowed women and men. Cultural factors also have a strong impact on sexual activity during old age. To the degree that societal
norms and values depict sexual desire and activity in very old age as out of bounds, old people may be discouraged from engaging in sexual behaviors. Not surprisingly, the present generation of older adults in Germany or America often refuses to report about their sexuality. We thus face the problem that there are not many reliable and representative data on the frequency of different sexual behaviors among older people (cf. Furchtgott, 1999).

**Occupation and similar activities.** The mandatory retirement age in Germany currently is 65 years. However, the median age at retirement in the German population has been closer to 60 than to 65 years during the last years, reflecting a societal trend toward early retirement that has dominated the last decades (cf. Kohli, 1994; Mayer, 1994). Only about 5% of the men and 2% of the women over 65 years still participate in the work force (Statistisches Bundesamt, 2000). Adjusting to retirement and finding other ways to occupy one’s time range among the developmental tasks of old people, particularly younger-old people (Havighurst, 1972; Peck, 1956). Consequently, personal life investment in the work domain does not so much reflect engagement in paid work, but rather other occupation-related productive activities, like volunteering, caregiving, community service, child care, gardening, or household chores. Considering this broader range of productive activities, we find that about 36% of Germans between 65 and 84 years engage in at least one of the activities of paid work, volunteering, caregiving, or child care. Participation in productive activity is further reduced during the fourth age (Kohli & Künemund, 1997). Obviously, it becomes impossible to clearly separate work and leisure once people are retired. Some people may define as work what others define as leisure. With the probable exception of the minority of elderly who are still working part-time or full-time, we thus can expect to see a considerable overlap between the activities that are relevant to PLI in the work and leisure domains.

**Leisure.** After retirement from work, people usually have more time available to engage in leisure activities. Tokarski (1993) estimated that German retirees average about 9 – 10 hours of daily free time. Leisure activities can be conceptualized as any activity engaged in for pleasure, intrinsic interest, or recreation rather than for business or from necessity. Those activities involve traveling, sports, cultural activities, adult education, gardening, shopping, playing games, socializing, reading, or television watching but may also involve activities like volunteering, community service, or child care. This heterogeneity of pursuits that may be associated with the domain “hobbies and interests” makes it difficult, if not impossible, to clearly separate leisure from work, socializing with friends, or caring for the well-being of one’s family. Moreover, multiple reasons and motives can be associated with leisure activities (for an overview see Furchtgott, 1999). Different classifications of leisure activities have been proposed to account for
this diversity. For instance, Stebbins (1992) distinguished between serious leisure, during which the individual makes an effort to find self-fulfillment, acquire and express special skills and knowledge, or be productive, and casual leisure, such as napping or television watching, that is, leisure activities that do not lead to self-development or produce valued goods and services. Serious leisure activities have been proposed as a substitute for occupational activities after retirement. The socially shared value that older people should lead an active life has been termed the “busy ethic” (Ekerdt, 1986). However, in “prescribing” engagement in serious leisure for older adults, it also needs to be considered that there is some lifetime continuity in leisure activities: Old people usually do not start to engage in completely new leisure activities but rather the patterns of leisure activities developed earlier in life persist into the later years (cf. Furchtgott, 1999; Maas & Staudinger, 1999). Furthermore, health constraints limit serious leisure pursuits. We therefore need to be careful not to ignore those limitations and consider serious leisure as a value for any and every older person.

Obligatory and optional PLI during old age. The domain-specific developmental changes can now be summarized to arrive at a more global characterization of change in life domains classified as obligatory and optional. Investments that are obligatory during old age are increasingly focused on aspects of biological (health, cognitive fitness) and cultural maintenance (thinking about life, death and dying), but also still involve basic forms of motivational (independence) and social (family) maintenance. This investment is often focused on maintenance and loss management, that is, obligatory investment in health, cognitive fitness, and independence cannot bring about long-term gains in functional capacity but may help to slow down decline and cope with loss. Here, neglect of obligatory PLI domains may lead to premature or unnecessary losses in adaptive capacity. Investment in family, life reflection, and death and dying can also lead to gain, for instance, increased emotional closeness with family members, acceptance of one’s life as lived, or reduced fear of dying. The developmental status in obligatory life domains further impacts on possibilities for optional investment. Poor health and cognitive impairments constrain social, leisure, sexual, and work-related activities. It is adaptive to reduce these resource intensive investments during old age when the necessary physical and cognitive resources are not available anymore.

The different obligations and options during old and very old age as compared to earlier phases of adulthood may also lead to changes in the functionality of obligatory PLI and optional PLI. In contrast to early and middle adulthood, the obligations of late life are more aversive in nature. Rather than raising children or working in a job, which may be perceived as challenging and stressful but also as highly rewarding, the old and oldest old have to deal with deteriorating health and cognitive ability, limitations to independent living, and impending death. The negative
affective consequences of obligatory investment, which can occur throughout the life span, could thus become especially prominent or even prevalent during old age. And indeed, older adults have been found to worry about their health and death (Skarborn & Nicki, 1996). Furthermore, the benefits from enduring negative affective consequences of obligatory investment also diminish with increasing age. Nonagenarians do not need to be worried about long-term developmental consequences but rather about short-term consequences to their well-being. To the degree that long-term negative consequences cannot occur or can no longer be prevented, obligatory PLI may lose part of its positive functionality and instead take on a more negative character. In contrast, optional PLI, per se, is more focused on immediate self-actualization and affect optimization and hence will be experienced as positive and enjoyable even by the oldest old. Again, this global positive functionality may not generalize to situations where resources for optional investments are lacking. That is, optional PLI is adaptive if the amount of investment matches the available resources.

The following chapters will provide more information on whether the suggested changes in the functionality of engagement with life occur during old and very old age. But first, it seems necessary to briefly consider the relationship between the concepts of obligatory and optional investment and the concept of a developmental task. The reader may have noticed that most of the identified developmental tasks were relevant to “obligatory” life domains, which leads to the question of whether obligatory PLI is equivalent to investment in developmental tasks.

The relationship between obligatory and optional PLI and developmental tasks. The necessity to maintain one’s functional capacity, health, and independence, but also to accept and review one’s life as lived and think about one’s death is much more readily perceived during old and very old age as compared to younger ages. Not surprisingly then, those domains of obligatory investment are included among the developmental tasks of old age. Still, obligatory investment is not conceptualized as an alternative way of referring to developmental tasks: For most phases of the life span, obligatory investments in independence or life reflection are not prominent among the proposed developmental tasks. Those obligatory pursuits are recognized as tasks only when losses in functional capacity impair the pursuit of alternative tasks and require more engagement with the “basic” aspects of living. In addition, the developmental tasks of old age also include involvement in new activities, hobbies, and interests. Although this engagement is highly beneficial to most of the young old and also many of the oldest old, it cannot be viewed as obligatory, age-normative, or essential to development for everyone.

In sum, obligatory PLI domains are not identical to the developmental task domains, although there is a high degree of overlap during old age. As both concepts try to identify what is central to human development, this is to be expected. However, the proposed tasks often focus
3 Late-Life Changes in Goals, Self-Concepts, and Activities

As outlined above, old people increasingly need to invest their resources into coping with non-normative life events and recovery from and adaptation to loss. Available resources simultaneously diminish, that is, aging involves declining physical and cognitive functioning and multimorbidity, which need to be compensated for by an increasingly less efficient social and cultural environment (cf. P. B. Baltes, 1997; P. B. Baltes et al., 1998; Staudinger et al., 1995). Evidently, the global and domain-specific developmental context just described for the elderly also impacts on their self-system, that is, their goals, self-views, and activities. The following sections focus on late-life developmental changes in personal goals, self-concepts, and daily activities. The changes in other self-regulatory constructs will help to derive hypotheses regarding developmental changes in PLI.

a Personal Goals

Kuhlen (1968) suggested that older persons invest less in life. And indeed, older people were found to report slightly reduced average personal life investment (Staudinger & Schindler, 2005) and fewer personal goals (Cross & Markus, 1991; Hooker, 1992; Parks, Klinger, & Perlmutter, 1988) compared to younger adults. During old age, the number of personal goals or, more specifically, the number of hoped-for possible selves further declined, whereas the number of feared selves did not show age-related differences (Smith & Freund, 2002). The view of reduced investment during old age is also corroborated by social expectations for the adoption of new goals during different life phases. Old and very old people were expected to adopt very few new projects compared to younger adults (Smith, 1999). However, older people also reported more active attempts to bring about their most important goals than younger adults (Cross & Markus, 1991). And social expectations for completing life projects did not change for different age groups (Smith, 1999). Thus, changes in the overall number of goals cannot be interpreted as the result of disengagement in late life. Rather, it is a reflection of changes in the goal system during old age, which may result from declining resources, deteriorating health, and less time left to live.

Changes in goal focus. Starting on a high level of abstraction, changes in the goal system during old age can be described as changes in goal focus. In accordance with the theoretical
propositions of lifespan psychology (P. B. Baltes et al., 1998; Staudinger et al., 1995; Figure 5, p. 67), goal focus shifts from growth (i.e., trying to reach higher levels of functioning) toward maintenance (i.e., preserving levels of functioning in the face of challenge) and regulation of loss (i.e., organizing functioning at lower levels; cf. Freund & Ebner, in press). It has been demonstrated that growth goals are very frequent in adolescence and maintenance goals increase in frequency during adulthood (Ogilvie, Rose, & Heppen, 2001). Older adults expressed more concern about maintaining achieved states of functioning and satisfaction than younger adults, who hoped for improvements in various life domains (Dittmann-Kohli, 1995). Further, maintenance goals were frequently named by older adults (Katzko, Steverink, Dittmann-Kohli, & Herrera, 1998) and still increased in frequency during very old age (Smith & Freund, 2002). In experimental studies, older adults were also found to more frequently select goals focused on maintenance and prevention of loss compared to younger adults who selected goals oriented toward growth (Freund & Ebner, in press). Nevertheless, in spite of old people becoming more invested in maintenance, old age cannot be viewed as a period of complete disengagement from growth goals. Although the maintenance motive became increasingly salient with increasing age, motives to acquire or grow were most frequently named as reasons for involvement in personal projects even in the oldest age group (mean age 73 years; Ogilvie et al., 2001). When asked about their future selves, a majority among the very old consistently reported pursuing improvement goals across two measurement points (Smith & Freund, 2002).

Similar results have been obtained for the related distinction between approach and avoidance goals. In general, people were found to hold more goals with an approach focus rather than an avoidance focus (e.g., Elliot & Sheldon, 1998; Emmons, 1996; Parks et al., 1988). As losses become more prevalent with age, the dynamic between approach and avoidance goals was suggested to gradually shift from predominantly approach goals to an increasing percentage of avoidance goals (Freund & Baltes, 2000; J. Heckhausen, 1997). And indeed, empirical evidence revealed that younger adults hold a higher share of goals reflecting an approach focus than do older adults (J. Heckhausen, 1997, 1999; see also Hooker, 1992; Parks et al., 1988). Still, even old people hold more approach than avoidance goals.

Central goal domains during old age. Several findings consistently emerged across a number of different studies comparing the goals of younger and older adults: Patterns of increasing frequency, importance, or salience with increasing age have been found for goals associated with one’s health, physical functioning, or independence, but also for goals related to leisure, free time, and civic and community issues (e.g., social welfare, volunteering, environment) (Brandstädter et al., 1989; Cross & Markus, 1991; Dittmann-Kohli, 1995; J. Heckhausen, 1997; Hooker, 1992; Hooker & Kaus, 1992; Lapierre et al., 1993; Nurmi, 1992; Staudinger & Schindler, 2005). De-
clining patterns were observed for work- or education-related goals and goals associated with financial welfare (Brandstätter et al., 1989; Cross & Markus, 1991; Dittmann-Kohli, 1995; J. Heckhausen, 1997; Nurmi, 1992; Staudinger & Schindler, 2005). The centrality of goal domains is also illustrated by the number of older people who identify domain-relevant goals. Most older adults held personal goals related to health, family, leisure, or independence (Frazier et al., 2000; Frazier, Johnson, Gonzalez, & Kafka, 2002; Hooker, 1992; Katzko et al., 1998; Lapierre et al., 1993; Smith & Freund, 2002). In addition, old people reported the highest personal life investment in the domains of health and family (Staudinger & Fleeson, 1996; Staudinger et al., 1999).

During old and very old age, additional shifts in the goal system have been observed. Health goals were shown to become more prominent with increasing age, whereas leisure or social relationship goals became less prominent (Frazier et al., 2000; Frazier et al., 2002; Hooker & Siegler, 1993; Smith & Freund, 2002). Leisure was the most important goal domain for people in their sixties, and health was the most important goal domain for people over 80 years. Impaired physical functioning was identified as one cause of this shift in preferences (Frazier et al., 2002). In line with this finding, the experience of losses in the past was associated with greater concerns for independence, stability, and maintenance of social relations (Rapkin & Fisher, 1992a). Very old age and functional limitations were also associated with an overall goal profile that is centered on self-preservation: These individuals were preoccupied with themselves, their health, and having a good death (Lapierre et al., 1993, 1997). Finally, people in poor health have been found to think more about their health-related goals (Hooker, 1992).

Change in goal dimensions. Finally, old age has been related to changes in the appraisal of personal goals. The potential to control and influence the world in accordance with one’s own goals and preferences diminishes with increasing age (cf. J. Heckhausen & Schulz, 1995). This is reflected in declining “action” resources, such as independence, good health, social status, or financial resources, and increasing “meaning” resources as indicated through life reflection, morale, religion, and faith (Brandstätter, Meiniger, & Gräser, 2003). Consequently, older people were shown to be less optimistic about the probability of goal attainment and perceived less personal control over accomplishing their goals than younger adults (Cross & Markus, 1991; J. Heckhausen, 1997; Nurmi, Pulliainen, & Salmela-Aro, 1992). These age differences in capability and likelihood of goal attainment also reflect the reported changes in most important goal domains. Old people increasingly need to invest in domains like health that are, per se, much less controllable (Cross & Markus, 1991; Nurmi et al., 1992).
b  Self-Concepts

Like personal goals, the self-concept undergoes some change during old age (e.g., Troll & Skaff, 1997). Late-life changes in both personality dispositions and self-definition have been documented (e.g., Carstensen, Pasupathi, Mayr, & Nesselroade, 2000; Costa & McCrae, 1997; Dittmann-Kohli, 1995; Field & Millsap, 1991; Freund & Smith, 1999a; Helson & Kwan, 2000; Mroczek & Spiro, 2003; Small, Hertzog, Hultsch, & Dixon, 2003; Smith & Baltes, 1999; Staudinger, in press). Here, I will focus on changes in and characteristics of the self-definition in old and very old age. As previously detailed, the self-definition can provide some hints regarding a person’s self-defining goals. Thus, changes in the self-definition may also point to possible changes in the goal hierarchy and goal investment.

The self-definition can be conceived of as an answer to the question “Who am I?” (Freund, 1995; Freund & Smith, 1999a). The resulting self-descriptions can be analyzed in terms of their content and structure (Filipp & Klauer, 1986; Filipp & Mayer, in press; Freund & Smith, 1999a; Staudinger & Greve, 1997). With regard to content, older persons were found to define themselves in terms of personal characteristics, previous life events, their life history, health and functional capacity, but also their hobbies and interests (Dittmann-Kohli, 1995; Freund & Smith, 1999a; McCrae & Costa, 1988). Older persons, as compared to younger adults, were less likely to define themselves in terms of work-related attributes (Byrd & Stacey, 1995; Filipp & Klauer, 1986), social relationships, or personality traits (McCrae & Costa, 1988). Moreover, the self-concepts of older adults displayed concern about greater moral integrity and willingness to express beliefs, while self-definition in terms of self-control, competence, or openness were less prevalent (Byrd & Stacey, 1995). Thus, the self-definitions of old persons, on the one hand, represent an activity-oriented lifestyle and continued engagement and, on the other hand, reveal that old people are self-reflective and review their lives. During the fourth age, people were found to base their self-definitions more on health and less on outdoor activities or social relations as compared to the third age (Freund & Smith, 1999a). Another interesting finding in this regard concerns the difference between self-definitions and possible selves generated by the same persons (Hauschild, 1996). Activities that are related to work, hobbies, or social participation still figured prominently in the self-definitions of the old and very old participants of the Berlin Aging Study, but at the same time, those activities were named only by a minority of the sample as aspects of their future possible selves. In contrast, health and life reflection were equally prominent in both present and possible representations of the self (Hauschild, 1996).

The structure of the self-definition also demonstrates some change with increasing age. At the beginning of the third age, the self-definition was shown to be more integrated than during younger adulthood, that is, there was more overlap in attributes considered as characteris-
tic of the self across different social roles (Diehl, Hastings, & Stanton, 2001; J. Dörner, 2005). With the beginning of the fourth age, however, the self-definition was shown to become less integrated again (Diehl et al., 2001). The complexity of self-defining thought evidenced decline in old age, that is, when defining themselves, older adults focused more on conventional traits and characteristics and less on dynamic aspects like context or transformation (Labouvie-Vief, Chiodo, Goguen, Diehl, & Orwoll, 1995). Older people, due to their physical constraints, also showed a reduction in the multifacettiness of their self-definitions: Fewer self-defining domains and aspects within domains were named (Freund, 1995). If we consider a rich and complex, but simultaneously well-integrated self-definition as desirable (cf. J. D. Campbell, Assanand, & DiPaula, 2003) the structural changes in the self-definition during old and very old age may be considered a loss.

Activities

We can think about changes in activity patterns in old and very old age along the lines of necessity and difficulty: With increasing age, functional impairments, and losses in cognitive functioning people perform fewer activities that are unnecessary to maintain independent living or are difficult to carry out (cf. Pushkar, Arbuckle, Maag, Conway, & Chaikelson, 1997). When studying everyday activity patterns, it is beneficial to reduce the large number of different activities that can be performed to a few meaningful categories. And indeed, the categories are often formed along the dimensions of necessity and difficulty: Activities requiring a basic versus expanded level of competence (M. M. Baltes et al., 1999; M. M. Baltes et al., 1993; Marsiske, Klumb, & Baltes, 1997), regenerative, productive, and consumptive activities (Klumb, 2001; Klumb & Baltes, 1999a), obligatory, committed, and discretionary activities (Verbrugge, Gruber-Baldini, & Fozard, 1996), obligatory and leisure, discretionary, or free time activities (M. M. Baltes, Wahl, & Schmid-Furstoss, 1990; Horgas, Wilms, & Baltes, 1998; Lawton, Moss, & Fulcomer, 1987; Moss & Lawton, 1982; Robinson, 1977), and finally, obligatory and optional activities (Pushkar et al., 1997) have been distinguished. Here, it should be pointed out that necessity and difficulty are not independent dimensions. Instead, activities necessary for survival or independent living are usually easier to perform than the more complex activities involved in many leisure, social, or productive activities.

To avoid confusions with obligatory and optional PLI (those two distinctions are not identical), the results on everyday activities during old age will not be summarized in terms of obligatory versus optional activities. Rather, the distinction between activities that require a basic level of competence (BaCo) and activities that require an expanded level of competence (ExCo) will be employed (M. M. Baltes et al., 1999; M. M. Baltes et al., 1993; Marsiske et al., 1997). BaCo...
includes activities that are necessary for survival or independent living, largely routinized, and highly familiar. These activities make up a large part of the activities considered as obligatory in other classifications, but highly challenging instrumental activities, like heavy housework, are excluded. ExCo activities move beyond mere existence and reflect much more personal preferences and motivations. Here, I will focus on more optional ExCo activities (e.g., leisure activities or meeting friends), although ExCo includes challenging obligatory activities as well.

Change in BaCo and ExCo activities. Activities that require a basic level of competence, such as personal care, medical treatment, shopping, or transportation, together with other instrumental activities of daily living (IADL; e.g., housework, financial or postal affairs) were found to make up about 60% of all activities engaged in during one day. The remaining activities that often require an expanded level of competence, that is, working, socializing, other leisure activities, and media consumption made up about 28% of activities (an additional 10% were devoted to resting; Horgas et al., 1998; see also M. M. Baltes et al., 1990). This picture changes somewhat if the duration rather than the relative frequency of activity engagement is considered: BaCo activities and other IADLs were most frequently engaged in, but they did not occupy the largest amount of time (34% of daily time). In contrast, the more “leisurely” ExCo activities took up about 46% of the day and resting required 18% of the day (Horgas et al., 1998). Further, activity profiles revealed that the more time required for BaCo activities, the less time is available for ExCo activities (M. M. Baltes et al., 1993). With increasing age or declining functional health, BaCo activities related to personal care, and activities like sleep and rest were shown to take up increasingly more time (M. M. Baltes et al., 1990; Horgas et al., 1998; Verbrugge et al., 1996; see also Lawton et al., 1987). Older people also reported more engagement in religious activity (Lawton et al., 1987).

With regard to ExCo activities, old age clearly brings a reduction in being physically active or productive (in an economic sense). More challenging physical activities like bicycling and gardening decreased across time in a sample of elderly men, while the amount of time spent walking remained stable (Bijnen, Feskens, Caspersen, Mosterd, & Kromhout, 1998). Deteriorating health and increasing age were associated with a decline in productive activities, such as gardening, child care, paid work, volunteering, or helping others. Still, older people do not stop being productive, but productive activities remain a characteristic part of their daily lives (Glass, Seeman, Herzog, Kahn, & Berkman, 1995; Kincade et al., 1996; Klumb & Baltes, 1999a; see also Staudinger & Schindler, 2002). As would be expected, the transition to retirement has been related to a large drop in time spent on paid work, while time spent on hobbies and leisure increased (Verbrugge et al., 1996). However, more passive forms of leisure, television watching and reading, were found to be the activities that occupy the largest amount of time spent on leisure activities (Horgas et
al., 1998). Poor health was found to reduce time spent interacting with friends, whereas interactions with family members were not reduced (Lawton et al., 1987). Another interesting finding with regard to more optional ExCo activities is that old people spent the more time on an activity (e.g., interacting with friends, reading or television watching) the more they reported liking it. In contrast, time spent on activities like personal care, eating, shopping, housework, or interacting with family was unrelated to the degree of liking of this activity. Moreover, time allocated to resting was negatively related to liking: The more one rests, the less one likes it (Lawton et al., 1987).

During the fourth age, the described activity patterns become even more pronounced (M. M. Baltes et al., 1999; Horgas et al., 1998). People performed fewer ExCo activities and, instead, spent more time on personal care (BaCo) and resting. More challenging activities like shopping, household chores, and transportation were reduced. Consequently, time spent at home further increased. In addition, the oldest old had a lower activity variety, that is, they performed fewer different BaCo or ExCo activities (Horgas et al., 1998; Klumb & Baltes, 1999a). More variety in very old age was only observed for resting activities, such as sleeping during the day, doing nothing, or planning (Horgas et al., 1998). Oldest-old as compared to old-old individuals are hence more selective in their activity engagement: They do fewer activities, which in turn take up more of their daily time.

The emergent picture can be summarized as follows: During the third age, people have gained some degrees of freedom, as they do not have to participate in the work force any more. To the degree that those old-old people are in relatively good functional health, they engage in a number of physical, social, leisure, and productive (i.e., ExCo) activities besides those activities that are necessary for personal maintenance (BaCo). During the fourth age, increasing levels of disability limit engagement in ExCo activities and also many BaCo activities, such as shopping and transportation, while time spent on activities like personal care (BaCo) or resting increases. However, many old and oldest-old individuals are able to handle functional limitations in an adaptive manner, in that they focus their energy investment on some central activities. They selectively optimize participation and compensate for losses in their most valued activities (cf. M. M. Baltes & Lang, 1997; Lang, Rieckmann, & Baltes, 2002; see also section E2).

The relationship between obligatory and optional PLI and BaCo and ExCo activities. When it comes to mere categorization of activities, irrespective of whether they are successfully and independently performed, we find that activities necessary for personal maintenance (BaCo) require obligatory investment. Nevertheless, obligatory PLI encompasses more than just BaCo-related activities. First, BaCo excludes activities like housework, financial affairs, or postal affairs, which are seen as part of obligatory PLI (and also of obligatory activities; Horgas et al., 1998). It is not
necessary that a person can perform these activities without help, but still each person needs to at least think about and organize these activities. Second, investment in one’s family is not viewed as merely one form of socializing. As humans are essentially social beings, some investment in a basic social network, as provided by the family, is necessary. Third, in reporting on daily activities, activities like thinking about life and death are often neglected. However, life reflection is an important aspect of obligatory PLI. Obligatory PLI is therefore a broader concept and includes more activities than those relevant for the assessment of BaCo. Obligatory PLI is also more general than the category of obligatory activities, as those still exclude engagement with one’s family and life reflection.

The activities relevant to optional PLI are similar to ExCo activities, but again, there are some exceptions. Time spent with relatives is excluded from optional PLI, and also activities like heavy housework, which require expanded levels of competence, but are still seen as obligatory. Both ExCo activities and optional PLI comprise engagement with leisure activities, meeting friends, and working. However, as activities related to sexuality are commonly not reported in elderly samples, no category targeted on sexual activities was included in the reported research on daily activities of old people. Still, even old people were found to report some investment in the PLI domain “sexuality” (cf. Staudinger & Fleeson, 1996; Staudinger et al., 1999).

As there is some overlap between activities relevant to obligatory PLI and BaCo and activities relevant to optional PLI and ExCo, some conclusions with regard to PLI development can be drawn from the reported findings on daily activities. With increasing functional limitations during old age, resources are withdrawn from ExCo activities, while BaCo activities are maintained as far as possible. In addition, activity engagement becomes more selective. Similarly, we can expect PLI selectivity to increase during old age, that is, investment is concentrated on central goal domains. This increasing selectivity results from reduced resource investment in optional goal domains, while investment in obligatory goal domains is preserved. In addition, the specific activities that reflect obligatory and optional investment change with increasing age. During the fourth age, obligatory investment increasingly reflects basic maintenance activities like personal care or resting. Consequently, the meaning of independence may be reduced to such basic forms of independence like living in one’s private household or being able to perform self-care activities without help. Optional PLI probably is expressed in very old persons more in terms of “passive” leisure activities or activities that are not physically challenging. Many of these optional activities can be performed at home.

Finally, the amount of time old people spent in obligatory activities like personal care, shopping, housework, or family interactions bore no relationship to whether they liked these activities or not. For optional activities like interactions with friends, in contrast, there was a clear
relationship between time allocation and liking (Lawton et al., 1987). This finding illustrates the more “personal” nature of optional as compared to obligatory investment. A substantial amount of obligatory investment is not dependent on personal preferences or interests, which, in turn, are more easily expressed through optional investment.

Together with the reported findings on personal goals and the self-definition in old age, these changes in activities help to make predictions regarding the development of the four PLI facets. However, in order to predict longitudinal developmental trajectories there are some methodological issues that need to be considered in addition to empirical (and mostly cross-sectional) findings. The following excursus treats some methodological challenges of longitudinal (and also cross-sectional) studies within a general framework of selection effects (cf. Nesselroade, 1988, 1990; Nesselroade & Jones, 1991).

4 Excursus: Peculiarities of Longitudinal Research in Old Age

Developmental psychology is oriented toward the description and explanation of constancy and change in behavior (e.g., P. B. Baltes, Reese, & Nesselroade, 1977/1988; Lerner, 2002; Wohlwill, 1973). This general aim has been more specifically formulated in terms of five rationales for longitudinal research (P. B. Baltes & Nesselroade, 1979): (a) Direct identification of intraindividual change and stability, as evident in changes in the level or frequency of the same class of behaviors or change from one class of behavior to another within one individual. These entity-specific change processes can be described in terms of intraindividual variability, intraindividual change, or ipsative stability. (b) Direct identification of interindividual differences or similarities in intraindividual change, that is, comparing change processes across individuals. Here, estimates of rank-order stability (i.e., correlations between repeated assessments of the same behavior at two time points) are often employed to draw conclusions about differential development. (c) Analysis of interrelationships in behavioral change. The aim is to study change from a multivariate perspective and identify behaviors that show similar or differential developmental trajectories. With this question in mind, a basic requirement is to address issues of structural stability or measurement invariance.

Thus far, the rationales have focused on the description of development. In addition, different forms of stability that are often used in the literature to describe development have been mentioned along with the relevant rationale. However, one highly studied kind of stability, namely, mean-level stability, has not been assigned to any rationale. Mean-level stability as a measure of stability and change in mean scores of a population under study does not explicitly consider intraindividual change, which has been identified as a prerequisite for all rationales.
Mean-level change allows some conclusions to be drawn with regard to individual level change, for instance, declining mean levels hint at declining trajectories for many, but not all, persons under study. Stable mean scores, however, can mask considerable intraindividual change, for instance, when half of the participants show increasing and the other half show declining patterns. Data on mean-level stability hence only allow very limited conclusions to be drawn on person-specific change and need to be complemented by other statistical information.

The remaining rationales focus on the explanation of development, namely (d) analysis of causes or determinants of intraindividual change and (e) analysis of causes or determinants of interindivial differences in intraindividual change. In order to make causal inferences it is necessary but not sufficient that the determining conditions are measured before the outcomes. Multiple measurements of determinants and outcomes in longitudinal studies are especially important if we expect to see not only proximal relations but also distal or delayed influences of the antecedent conditions.

Longitudinal data are ideally suited to address all five rationales. Still, employing longitudinal data also involves a number of challenges and has certain drawbacks, some of general concern to any empirical study, some specific to longitudinal studies. The challenges and problems inherent in longitudinal research can be discussed within a general framework of selection and selection effects (cf. Nesselroade, 1988, 1990; Nesselroade & Jones, 1991). Whenever we conduct a study, we do not only draw a sample of participants, but also samples of variables and measurement occasions (e.g., Cattell, 1966). Moreover, in analyzing the data we usually realize only a subset of the possible analyses, which may substantially influence our results and conclusions (e.g., Ferrer & McArdle, 2003; Hertzog & Nesselroade, 2003). The sampling of persons, measurement occasions, variables, and statistical analyses will now serve as a background to address some issues in longitudinal research.

Selection of Persons

Discussions of the generalizability of research results most often focus on the question of whether the realized sample is representative of the population of interest. Here, we need to consider that the population of potential interest to aging studies is not simply all those older persons living during the time of study, but all older persons in general, that is, those currently living, those who lived in the past, and those who will live in the future. Whenever we draw a sample of older persons and study them across time the observed developmental change is influenced by one or more of three sources: age, cohort, and period (time-of-measurement) effects (Schaie, 1965, 1986). Unless the study is designed in a way that allows for the separation of the three effects (cf. Schaie, 1994), we cannot expect that the established age-related
trajectories will remain in later cohorts or at different historical times. Thus, single-cohort longitudinal studies (like the Berlin Aging Study), strictly speaking, do not allow for generalizations beyond the studied cohort.

But even generalizations to the cohort under study may be limited. Sample bias and nonrandom sample attrition pose a threat to the generalizability of longitudinal findings (e.g., P. B. Baltes et al., 1977/1988; Lindenberger, Singer, & Baltes, 2002). That is, the realized sample may represent a positive selection among the older population with regard to health, cognitive functioning, or life expectancy beginning at the first measurement occasion. In addition, younger, healthier, or better functioning individuals may also be more likely to participate in a longitudinal study for a longer period of time. With populations of older adults, selective dropout can originate from two different sources, namely death and nonparticipation. Mortality-associated selectivity refers to dropout due to death and experimental selectivity refers to dropout due to nonparticipation of people who are still alive (Lindenberger et al., 2002; see also Singer, Verhaeghen et al., 2003). Mortality-associated selectivity is best understood as a population process that does not compromise the validity of longitudinal observations. In contrast, experimental selectivity introduces a sampling bias that limits the generalizability of longitudinal observations. Whenever we find evidence for sampling biases we need to consider that the resulting description and explanation of developmental change may not hold true for the aged population in general. Consequently, before developmental trajectories of PLI are computed, selectivity effects for the four PLI facets need to be estimated to determine whether the obtained results may be generalized to the population of older West Berliners.

b Selection of Measurement Occasions

As previously mentioned, period or time-of-measurement effects may be present in longitudinal data. Those effects are often conceptualized as the impact of specific historical events (Schaie, 1965, 1986). Considering the selection of measurement occasions from a broader perspective, one may think about all effects that result from the sampling of time points, regardless of whether they affect the entire sample, parts of the sample, or just individual participants. A basic decision in every longitudinal study involves the question of how often and when participants are to be observed. It may seem desirable to have as many observations as possible to draw valid conclusions about change patterns. A possible disadvantage of this strategy is that many assessments in close succession may also lead to unwanted retest effects or satiation and fatigue in the participants. An advantage is the possibility of disentangling intraindividual variability, that is, short-term fluctuations, from intraindividual developmental change (cf. Nesselroade, 1991; Nesselroade & Featherman, 1991). For instance, Nesselroade and Featherman
(1991) suggested the strategy to include “bursts” of repeated measurements in longitudinal studies to estimate intraindividual variability in addition to developmental change. A person’s characteristic range of variability is itself an aspect of personality (already Murray, 1938) but also undergoes developmental change or is predictive of change in other variables (cf. Nesselroade & Ghisletta, 2000). The following paragraph illustrates the possible consequences of not knowing about the amount of intraindividual variability in PLI for conclusions with regard to PLI development.

**PLI as trait and state.** Personal life investment has been introduced as a construct that encompasses investment in relatively stable self-defining or long-term goals and also more short-term concerns and daily activities. PLI ratings may also be influenced by temporary mood states at the time of testing. Moods can influence the retrieval of information from memory and the perception and judgment of the current state of affairs (e.g., Morris, 1999). Hence, mood effects may introduce some random variation to PLI ratings. Consequently, every PLI rating contains trait-like and state-like aspects. Change in PLI across time can thus be attributed to short-term intraindividual variability (attributable to, e.g., the specific activities or concerns immediately prior to testing, the influence of affective states, or specific events on the testing day) and true intraindividual change. Substantial amounts of short-term intraindividual variability during old age have been found for many constructs, such as self-rated health and activity (Ghisletta, Nesselroade, Featherman, & Rowe, 2002), depressivity (Nesselroade & Featherman, 1991), perceptions of control (Eizenman, Nesselroade, Featherman, & Rowe, 1997), or worldviews and religious beliefs (Kim, Nesselroade, & Featherman, 1996). It seems safe to assume that PLI ratings would similarly show some short-term fluctuation. As a consequence, we need to face the problem of disentangling short-term variability and developmental change in PLI. Figure 6 illustrates this problem.

If we assume that a person shows systematic linear decline in PLI, but simultaneously exhibits some intraindividual variability in PLI, measuring PLI four times may result in quite different observed trajectories, depending on the selected time of measurement. If we happened to always assess PLI at the outer ranges of short-term variability (trajectories A and B), we may estimate developmental trajectories that depart from the actual trend. In evaluating change in PLI, it is thus desirable to avoid bias due to processes of intraindividual variability as far as possible. The application of latent growth models (e.g., McArdle & Anderson, 1990; McArdle & Bell, 2000; McArdle & Hamagami, 1991; McArdle & Nesselroade, 2003) is one step in this direction.
Selection of Variables

I want to highlight two important aspects of the selection of variables. First, each construct we want to assess can be marked by a large number of possible variables or indicators. The specific indicators we select may provide a more or less valid representation of the latent construct. Sometimes, even a set of seemingly good indicators, that is, indicators that show high internal consistency, may provide a bad representation of the construct of interest and hence lead to wrong conclusions. Moreover, indicators with a low internal consistency may sometimes provide a good representation of the intended construct (T. D. Little, Lindenberger, & Nesselroade, 1999).

Second, the selection of variables is important for the determination of causality. Even if one variable is identified as an antecedent of change in another variable, we can never exclude the possibility that both variables are actually jointly dependent upon some third variable. This variable may have been measured but not selected for the present analyses or it may not be part of the data set at all. Therefore, strict models of causation have identified the possibility of controlled manipulation as necessary for determining causality (cf. P. B. Baltes & Nesselroade, 1979; P. B. Baltes et al., 1977/1988). As researchers cannot and do not aim to intervene in the course of longitudinal studies, it is impossible to find evidence of causality in this strict sense. Rather, many findings are limited to the demonstration of correlated change.

Moreover, if one is to take the notion of developmental systems seriously, the assumption of unidirectional causality loses its meaning. Dynamic interaction implies that “what may function as a criterion or dependent variable at a certain stage of a process may, at the next stage, serve as a predictor or independent variable” (Magnusson & Stattin, 1998, p. 702). The study of “causal-

Figure 6. Impact of short-term intraindividual variability and systematic intraindividual change on observed developmental trajectories.
ty” thus always requires consideration that every variable may impact on every other variable and may, in turn, be influenced by every other variable.

**d Selection of Analysis Strategies**

Much could be said about how one’s analysis strategy can influence one’s findings (e.g., Ferrer & McArdle, 2003; Hertzog & Nesselroade, 2003). Among those possibilities, I want to focus on the time perspective one can employ in describing late-life developmental change and on the impact of the timing and spacing of measurement occasions on the analysis of “causal” effects.

*Time perspective.* Obviously, longitudinal observations are ordered along the dimension of time-of-measurement and it seems straightforward to describe intraindividual change from the first to the last measurement occasion. Still, our interest in developmental research is not so much to describe change across a limited number of years, say six to ten, but rather to establish developmental trajectories across the entire age range studied, in the case of the Berlin Aging Study 70 to 100 years. This becomes possible with latent growth models, where the information from different curve segments can be linked to estimate the entire longitudinal curve (e.g., McArdle & Hamagami, 1991). However, this possibility also leads to a number of possible ways to arrange longitudinal data for analyses. In developmental analyses we are often interested in functions over time-of-measurement, age-at-measurement, and time-until-death-at-measurement (e.g., McArdle & Anderson, 1990; McArdle & Bell, 2000). It has been found that change in older populations is not only related to age, but that there are additional changes within individuals that are related to approaching death. The distinction between a “normal aging track” and a “death track” or the concept of “terminal drop” illustrates the difference between age-related decline in functioning and death-related accelerated rates of decline (Berg, 1996; Riegel & Riegel, 1972). If accelerated change prior to death occurs in a variable (e.g., a terminal drop in cognitive functioning has been demonstrated; Berg, 1996; Small & Bäckman, 1997, 1999), estimates of age-related change are confounded with death-related change (cf. P. B. Baltes et al., 1977/1988; Hertzog & Nesselroade, 2003).

This study focuses on changes in PLI across time-in-study and chronological age, as accelerated change prior to death so far has not been reported for variables in the realm of self and personality. Moreover, most participants have not been interviewed in close proximity to their deaths and it seems unlikely that terminal change in PLI will be observed more than one year prior to death. Here, it should be noted that, of course, increasing age per se does not cause anything and is merely a dimension along which behavior changes are studied (Wohlwill, 1970).
Still, increasing age can be conceptualized as a proxy for all the risks and experiences of loss linked to old age that may lead to changes in PLI.

The impact of timing and spacing of measurement occasions on analysis strategies. The selection of data analysis strategies is not completely up to the researcher but is also dictated to some extent by the design of the study. This issue is relevant, for instance, when one wants to study the dynamics of change between two or more variables, that is, how multiple variables influence each other across time. Here, the crucial question is whether the timing and spacing of assessments can capture the changing states of the variables of interest (Hertzog & Nesselroade, 2003). As self-regulation operates on relatively short time scales, longitudinal studies with measurement intervals of one or more years are, strictly speaking, not suited to study the dynamics of self-regulation. This means that the estimation of lagged effects (i.e., effects of variable X at time \([t]\) on variable Y at time \([t+1]\) and vice versa) may be a fruitless endeavor. In a situation where the interval between a putative cause and its putative effect is much shorter than the interval between the repeated assessments, the estimation of contemporaneous effects (effects within time \([t]\)) may be favored over the estimation of lagged effects (Hertzog & Nesselroade, 2003). This issue will again be considered when hypotheses on the relation between obligatory PLI and optional PLI are derived.

5 Hypothesized Late-Life Changes in Personal Life Investment

The previous theoretical and methodological considerations can now be integrated to formulate hypotheses on the development of the four PLI facets. The first three hypotheses to be formulated are based on the previous considerations regarding differences between obligatory PLI and optional PLI. That is, strictly speaking, these hypotheses again have to do with the validation of this distinction. However, as they require the previous methodological considerations as a background and can only be tested with the longitudinal BASE sample, they have been included in the second set of hypotheses. The remaining five hypotheses specify the predicted developmental changes in the four PLI facets and the predicted relation between changes in obligatory PLI and changes in optional PLI.

Testing for sampling bias, estimating rank-order stabilities, or comparing longitudinal age trajectories to cross-sectional age trajectories belong to the standard procedures that are performed when working with longitudinal data. They are essential to determine the reliability and validity of findings. In this study, these procedures also serve a second function: They can help to further validate the distinction between obligatory PLI and optional PLI. The statement that
some kinds of investment are obligatory, that is, that they need to be performed by every older person regardless of his or her health, liking of the required activities, or personal preferences, implies that, no matter how persons are selected for a study, one can always expect to find relatively high levels of obligatory investment. This general argument can now be spelled out with regard to estimates of sampling bias, rank-order stabilities, and comparison of cross-sectional and longitudinal findings.

If obligatory PLI is stable during old age, regardless of health status, resource availability, or distance from death, it can be expected that mortality-associated selectivity for obligatory PLI is around zero. That is, even if the study tends to include participants who are younger and healthier compared to the general aged population, their obligatory PLI does not differ from that of older and frailer persons. Similarly, if obligatory PLI does not demonstrate systematic late-life change, rank-order stability estimates do not systematically differ with different time intervals between assessments. Optional PLI, in contrast, is predicted to be lower in older people. Resource losses are assumed to require reduced optional PLI—an assumption that is supported by the reported findings of fewer personal goals, self-definitions, and activities in life domains considered as optional (e.g., leisure, friends, work). As older people are also more likely to die and hence drop out of longitudinal studies, a small amount of mortality-associated selectivity is expected for optional PLI. This selectivity is hypothesized to vanish once selectivity estimates are controlled for age. Moreover, rank-order stability of optional PLI is expected to decrease with increasing time intervals between measurement occasions. If older people, overall, tend to reduce optional PLI but do so beginning at different ages and with different rates of change, the initial rank-order of participants becomes increasingly altered with increasing time intervals. Finally, if obligatory PLI does not change across age and there is no sampling bias with regard to obligatory PLI, there is no reason why cross-sectional and longitudinal findings for obligatory PLI should differ. In contrast, if mortality-associated selectivity is present for optional PLI, the estimated longitudinal trajectories are assumed to show smaller age-related decline in optional PLI compared to the more representative cross-sectional trajectories.

In sum, hypothesis 2a states that a small amount of mortality-associated selectivity is present for optional PLI but not for obligatory PLI. Mortality-associated selectivity in optional PLI vanishes when it is controlled for age. It is further predicted that rank-order stability of optional PLI declines with increasing time intervals. Rank-order stability of obligatory PLI shows no systematic changes with increasing time intervals (hypothesis 2b). And finally, hypothesis 2c predicts that the estimated developmental trajectories for optional PLI across age differ when comparing cross-sectional and longitudinal findings. Less developmental change is observed with the longitudinal data. The estimated trajectories for obligatory PLI do not differ when comparing cross-sectional and longitudinal findings.
Before predictions on the development of the four PLI facets are made, it seems important to again stress that average PLI is the mean across obligatory PLI and optional PLI and hence will show trajectories that are somewhere in between the trajectories of obligatory PLI and optional PLI. PLI selectivity, as an index of the intraindividual variability across the ten PLI domains, is less closely related to obligatory and optional PLI. Variability can arise within and between obligatory and optional domains.

In reaction to the cumulating losses that are associated with increasing age, older people are expected to reduce their engagement with life between 70 and 100 years of age. However, reducing overall life investment does not imply withdrawing energy across all life domains. Rather, setting priorities and selectively focusing on the most important life domains is a typical and adaptive reaction. The differentiation between obligatory PLI and optional PLI was made to distinguish between those most important and less important life domains. Obligatory PLI is central to self-maintenance and hence a necessary basis for development. Optional PLI contributes to successful development if this investment is matched with one’s resources. Still, under conditions of severe resource limitation it is not adaptive to spend the remaining resources on optional PLI at the expense of obligatory PLI. Less resource-demanding optional pursuits have to be selected when resources become scarce. People are thus expected to reduce their optional PLI and simultaneously maintain their obligatory PLI between the ages of 70 and 100. Consequently, average PLI should show a small age-related decline. And indeed, average PLI and age correlated with $r = -.17$ in the cross-sectional BASE sample (Staudinger et al., 1999). Along with declining optional PLI, PLI selectivity is predicted to increase slightly. The reported findings of fewer personal goals, self-definitions, and activities in optional life domains like leisure, work, or education and more goals and activities in obligatory life domains like health, physical functioning, or independence with increasing age and declining health support these predictions. Here, the question of why obligatory PLI is not expected to increase during old age may arise, given that older people report more goals, self-definitions, or activities pertaining to health and independence. The central reason that this is not assumed is the different ways of assessing goals, self-definitions, activities, and PLI. In contrast to the other constructs, PLI is assessed with a rating scale. This means that there is an upper limit to PLI. Once this limit has been attained it is not possible to report further increases (ceiling effect). Ratings of PLI in the domains health and family especially have been found to be near the maximum of the scale as early as during the seventies (e.g., Staudinger et al., 1999), which precludes observation of further late-life increases on an average level.

Longitudinal trajectories of the four PLI facets are determined first across time-in-study (up to 10 years) and then across the entire age range contained in the longitudinal BASE sample.
D5 Hypothesized Late-Life Changes in Personal Life Investment

(70 – 101 years). Two considerations seem important before specific change patterns of PLI can be predicted. First, developmental trajectories based on longitudinal and cross-sectional data do not always look identical (e.g., Salthouse, 2000; Zelinski & Burnight, 1997). Cohort effects and selective dropout are only two factors that may be responsible for those differences. This implies that, if the longitudinal BASE participants represent a positive selection among the initial participants, the longitudinal PLI data may suggest less “negative” developmental trends compared to the cross-sectional PLI data. Cohort differences in PLI in the cross-sectional BASE sample would further complicate predictions. Up to now, we cannot definitely rule out that the negative correlation between average PLI and age in the cross-sectional sample is a cohort rather than an age effect (although it seems unlikely).

Second, apart from cohort and selectivity effects, a simple reason for departures between cross-sectional and longitudinal trajectories should not be overlooked: Intraindividual longitudinal change is usually not observed across the same time interval or age range that is covered in a cross-sectional study. This consideration is particularly important when change is described across time-in-study. If average PLI slightly declines across the 30-year age range covered in BASE at T1, we cannot conclude that significant intraindividual decline will be evident across the 8 or 10 years covered in the longitudinal study (cf. Salthouse, 2000). Even for memory, which clearly shows decrements with increasing age, a time interval of about 6 years was advised if statistically reliable longitudinal declines are to be assured (Zelinski & Burnight, 1997).

Change patterns of PLI as a function of age-at-measurement in the longitudinal sample are expected to be similar to the cross-sectional findings—maybe less pronounced. As previously stated, some change in PLI is predicted for optional PLI (declining) and PLI selectivity (increasing). Obligatory PLI is predicted to remain stable on average. Based on these predictions and the cross-sectional findings a slight reduction of average PLI is also expected. Here, the observed age-related changes are not necessarily linear. The distinction between the third and fourth age has been introduced to illustrate that late-life development takes a more negative turn for many older adults with the beginning of the eighties. This implies that optional PLI and average PLI may not show a linear declining trend between 70 and 100 years but rather remain relatively unchanged until the beginning of the fourth age and start to decline from about 80 years onward. For two reasons, it further seems unlikely that this declining trend will continue during the ninth and tenth decade of life. First, some people may reach a level of PLI that cannot be further reduced and thus they stop changing (floor effect). Second, survival becomes increasingly selective the closer one gets to 100 years. As briefly discussed in section D1, the population of nonagenarians and centenarians may thus comprise a larger share of people who did not experience substantial age-related losses until very late in life. If a sample aged 90 years
and older is comprised of those people who have reached the floor of possible PLI scores and those who are extremely resilient and thus show only little change in PLI, the resulting picture may be stability, albeit on a lower level compared to the seventh decade of life. In line with this assumption, some self and personality constructs in BASE were found to be stable during the seventies, to decline during the eighties, and to stabilize again during the nineties (J. Smith, personal communication, March 2, 2004; Smith, Borchelt, Maier, & Jopp, 2002). Among these constructs were indicators of an approach temperament, that is, positive affect and extraversion, and also openness to experience and aging satisfaction. Optional PLI and, to a smaller extent, average PLI are expected to decline during old age and may demonstrate this kind of trajectory when development is modeled across the entire age range in BASE. Similarly, PLI selectivity may be stable during the seventies, increase during the eighties, and again be stable during the nineties. Still, those predictions are tentative. Therefore, hypotheses on developmental trends of the four PLI facets will be formulated in more general terms and just specify whether a PLI facet is expected to increase, to be stable, or to decline.

When change in PLI is modeled across time-in-study, the previous considerations apply: If change across 31 years is quite small, no change will be evident when only 10 years are considered. Therefore, a dominant picture of no mean level changes in the PLI facets across 10 years is expected. Specifically, average PLI, PLI selectivity, and obligatory PLI are hypothesized to be stable across time. Optional PLI is expected to show the largest decline across age and hence to also show at least some slight decline across the ten years in BASE.

Hypotheses 2d – 2g summarize the expected developmental trajectories across both age and time-in-study. Specifically, hypothesis 2d states that average PLI decreases when modeled across age (31 years) and remains unchanged when modeled across time-in-study (10 years). According to hypothesis 2e, PLI selectivity increases when modeled across age and remains unchanged when modeled across time-in-study. Hypothesis 2f predicts that obligatory PLI remains unchanged when modeled across both age and time-in-study. And finally, it is expected that optional PLI decreases when modeled across age and decreases when modeled across time-in-study (hypothesis 2g).

Hypotheses 2d – 2g were formulated with regard to average developmental trends. Still, PLI as a self-regulatory construct should be especially sensitive to interindividual differences in resources and vulnerabilities. Age-related losses that may contribute to declining optional PLI and increasing PLI selectivity are not omnipresent during old age. For instance, some older adults can be characterized as already being in the fourth age during their seventies while others do not yet show developmental changes typical of the fourth age at over 90 years. Moreover, positive changes in one’s developmental context may be less likely but still occur even in the oldest old. Depending on his or her changing developmental context, each participant is likely to show a
different PLI trajectory that may substantially depart from the predicted average trajectory. We can thus expect to see some interindividual variability in change patterns across age and time, especially for optional PLI.

In a final step of this second major part of analyses, the development of obligatory and optional PLI across time will be linked. The functionality of obligatory PLI and optional PLI in part depend on each other. For instance, optional PLI at the expense of obligatory PLI is not expected to contribute to successful development. Theoretical considerations (Peck, 1956) and empirical findings (Lapierre et al., 1997) also pointed to possible negative consequences of becoming preoccupied with obligatory domains such as one’s health, functioning, and death during old age. That is, an overly selective focus on obligatory PLI combined with very low levels of optional PLI may be detrimental to one’s well-being. Obligatory PLI and optional PLI thus need to be held in a good balance in order to meet life’s basic necessities but also make the best of one’s aging and enjoy optional pursuits such as leisure activities and socializing with friends. A dynamic model linking the longitudinal development of obligatory and optional PLI will be fitted to the data. On theoretical grounds, it is expected that there is a dynamic relationship and functional interdependence between the two PLI facets. Specifically, it is predicted that obligatory PLI has a dominant impact on optional PLI. If resources are not sufficient to meet one’s obligations they also cannot be invested in optional pursuits. Thus, reducing one’s obligatory PLI also implies reducing one’s optional PLI. In contrast, changes in optional PLI are assumed to have no impact or only little impact on changes in obligatory PLI. Optional PLI may help to compensate for some obligatory shortcomings and hence have a small impact on obligatory PLI. Still, obligatory PLI is expected to play the dominant role in determining the possible amount and functionality of optional PLI. It is thus hypothesized that change in obligatory PLI impacts on change in optional PLI. Change in optional PLI has only a small impact or no impact on change in obligatory PLI (hypothesis 2h).

This hypothesis clearly pertains to lead-lag relationships between obligatory PLI and optional PLI across time-in-study. However, the measurement occasions in BASE are separated by at least one up to several years. As already mentioned, this makes it difficult, if not impossible, to detect self-regulatory processes that are supposed to operate during relatively short time intervals. Thus, the hypothesized direction of causation is first tested with a model that considers only contemporaneous reciprocal effects between change in obligatory PLI and change in optional PLI (cf. Schooler & Mulatu, 2001; Schooler, Mulatu, & Oates, 1999). Cross-lagged relations between changes in the two PLI facets are then tested in a second model. However, it is likely that this model will not demonstrate any lead-lag relationships between change in obligatory PLI and change in optional PLI due to too long time intervals between measurements.
E GOAL STRIVING AND SUCCESSFUL AGING

Up to now, the domains and aspects of engagement with life and their development during old age have been described without attempting to explicitly judge the functionality of various forms of engagement. Now, the changes described are related to changes in health status and subjective well-being. Both health and subjective well-being assume a prominent role in theories and research on resilience and successful aging. Thus, the central question of the following sections can be summarized as: How do changes in PLI, personal goals, and activities during old age relate to resilience and successful aging? In order to address this question, it is necessary to first specify the meaning of successful aging.

1 Definition of Successful Aging

At first glance, the term “successful aging” appears straightforward. Everyone has an intuitive understanding of what successful aging means. Images of happy, satisfied, healthy, wealthy, independent, beloved, caring, active, and interested older people easily come to mind. Not surprisingly, the term has become very popular in the psychological literature. Entering the keyword “successful aging” in Psycinfo results in a list of 403 entries (January 4, 2005)—an amount of information that is not easily reviewed. The problem with the intuitive appeal and popularity of the concept of successful aging is that it has been so widely employed that we have lost track of a generally agreed upon definition (cf. Freund & Riediger, 2003): What successful aging means is in the eye of the beholder.

In the following, different attempts at conceptualizing successful aging are compared. A first attempt is to differentiate pathological, normal, and successful aging on a statistical basis (cf. P. B. Baltes & Baltes, 1990; Gerok & Brandstädter, 1994; Schulz & Heckhausen, 1996; Wong & Watt, 1991): Individuals who exhibit typical nonpathologic age-associated changes are classified as normal or usual agers. Pathological aging is characterized by an unusual amount of disability and physical or mental disease. Individuals who exhibit little or no loss in function relative to the average of younger adults are classified as successful agers. A problem with this definition is that normal, in a statistical sense, merely refers to average levels of functioning that have been observed at a specific time, in a specific culture, and in a specific population. Across different times, cultures, and populations this normal state may show considerable variations. Thus, someone who is considered a “successful ager” in one context may not be considered successful in another context.
An alternative approach to successful aging is to specify criteria that must be fulfilled by the “successful ager.” Different criteria that have been proposed are subsequently identified. In order to integrate and compare different proposals of criteria for successful aging and arrive at an understanding of what successful aging means a teleonomic model of subjective well-being is employed (Figure 7). This model shows how goal investment, depending on available resources, may contribute to subjective well-being. Two central assumptions are illustrated. First, being committed to personal goals and investing in those goals does not per se lead to increased well-being. Rather, the strength of goal commitment determines the extent to which well-being experiences depend on the pursuit of personal goals but the direction of change in subjective well-being ultimately depends on one’s progress in goal attainment (Brunstein, Schultheiss, & Maier, 1999; see also Brunstein, 1993; Hooker & Siegler, 1993; Pomerantz et al., 2000). If someone is highly committed to a goal, attaining the goal contributes to well-being. However, failure to attain the goal is associated with a decline in well-being. Thus, being highly committed to unattainable goals and investing a lot of energy in goal striving is detrimental to well-being. The second assumption is that the resources an individual has available impact on her or his goals, the amount of energy that can be invested in goal striving, and the chances of making progress toward goals. If the individual selects goals that can be attained with the available resources, goal investment will most likely lead to progress toward these goals and, ultimately, high well-being. In contrast, if goals are selected that cannot be attained with the available resources investment in goal striving is limited and will most likely not lead to progress toward these goals. Further investments can then only be made in the form of rumination or worry unless the goal is given up. Goals that are not matched with one’s resources are thus detrimental to one’s well-being.

![Figure 7. Teleonomic model of subjective well-being.](image-url)
In the following, the teleonomic model of well-being serves two purposes. First, it helps to illustrate different conceptualizations of successful aging. Briefly stated, successful aging models differ as to whether they define success merely in terms of the outcome, that is, high subjective well-being, or in terms of having resources available, investing resources in goal striving, and, as a result, reporting high subjective well-being. Alternatively, process models of successful aging have moved away from specifying criteria for successful aging and rather described the processes illustrated in Figure 7. Second, empirical support for the model is reported specifically with regard to old age.

Proposed criteria for successful aging. One approach to successful aging is to employ the perspective of the individual. Historically speaking, life satisfaction, as conceptualized in terms of taking pleasure from daily activities, regarding one’s life as meaningful, feeling one has succeeded in achieving major life goals, having a positive view of oneself, and maintaining happy and optimistic attitudes and moods (e.g., Havighurst et al., 1968; Neugarten, 1974/1996b), has been one of the first indicators of successful aging (cf. Rudinger & Thomae, 1990). The construct life satisfaction was used to test the validity of activity theory (e.g., Havighurst, 1961; Havighurst et al., 1968; Lemon et al., 1972; Maddox, 1965) as opposed to disengagement theory (Cumming & Henry, 1961). Here, it has been found that activity level per se is not related to life satisfaction. Rather, both disengagement and continued activity, depending on life domains, activities, social roles, environmental aspects, or personality characteristics, can be related to well-being or life satisfaction in old age (Havighurst et al., 1968; Maddox, 1968; see also Carstensen et al., 1999; Thomae, 1990).

Up to now, life satisfaction, or rather the broader concept of subjective well-being, has advanced to the most prominent single criterion for successful aging (cf. Freund & Riediger, 2003). Subjective well-being, in most definitions, encompasses three aspects relevant to the global evaluation of one’s life: The more cognitive aspect of life satisfaction and the affectional aspects of positive emotionality and negative emotionality (e.g., Andrews & Withey, 1976; Diener & Suh, 1998; Lucas, Diener, & Suh, 1996). It should be noted here that, although life satisfaction, positive affect, and negative affect are related, they are empirically separable and show differential relationships with age or personality variables (DeNeve & Cooper, 1998; Diener & Suh, 1998; Lawton, Kleban, Rajagopal, & Dean, 1992; Lucas et al., 1996). Negative affect declines with increasing age or stays at least stable (for overviews see e.g., Diener & Suh, 1998; Kunzmann, Little, & Smith, 2000; Magai, 2001). The evidence for positive affect is mixed. Different studies pointed to stability or decline in positive affect with increasing age (Carstensen et al., 2000; Diener & Suh, 1998; Gross et al., 1997; Mroczek & Kolarz, 1998; Smith, Flesson, Geiselmann, Settersten, & Kunzmann, 1999). However, the findings of declining trends in old age can be
attributed to the high-arousal emotions employed in most studies and do not generalize to low-
arousal emotions, that is, high-arousal emotions decline during old age but low-arousal emotions
do not (Pinquart, 2001a). Life satisfaction was shown to be stable well into old age (Diener &
Suh, 1998; Palmore & Kivett, 1985; Smith et al., 1999). The finding that age, despite age-related
loss and decline in external and internal resources, has no or only little negative effect on sub-
jective well-being has been labeled a paradox (e.g., Staudinger, 2000; Staudinger et al., 1995; see
also Brandtstädter & Greve, 1994). On the one hand, it is good news that most people can adapt
to even highly adverse circumstances without long-term reductions in subjective well-being (cf.
Diener, 2000). On the other hand, we need to ask whether subjective well-being is a sufficient
criterion for successful aging. Is it enough that a bedridden person tells us she is quite happy and
satisfied with her life?

Several theorists have recognized that the single criterion of subjective well-being is not
enough and proposed multiple criteria to define successful aging (e.g., P. B. Baltes & Baltes, 1990;
Lawton, 1983; Rowe & Kahn, 1997). These criteria usually pertain to the possession of resources
and active engagement with life. For instance, the resource indicators of good physical and
mental health, good physical and cognitive functioning, behavioral competence, or longevity were
frequently named (P. B. Baltes & Baltes, 1990; Garfein & Herzog, 1995; Lawton, 1983; Rowe &
Kahn, 1987, 1997). With regard to goal investment, criteria like active engagement with life,
productive involvement in society, social competence and productivity, or perceived personal
control have been considered (P. B. Baltes & Baltes, 1990; Garfein & Herzog, 1995; Rowe &
Kahn, 1987, 1997). Nevertheless, there has been some debate as to whether an older person has
to meet all criteria to be considered as aging successfully. Rowe and Kahn (1987, 1997) are
proponents of the view that the “successful ager” needs to meet all of their criteria. Researchers
building on Rowe and Kahn’s criteria have found that the proportion of individuals classified as
successful agers typically ranged between 20% to 33% of a sample (Strawbridge, Wallhagen, &
Cohen, 2002). However, there is a large discrepancy between the classification by Rowe and
Kahn’s criteria and the self-classification of older individuals: In a study by Strawbridge et al.
(2002), only about 19% were classified as aging successfully by Rowe and Kahn’s criteria, but
about 50% of the sample thought of themselves as aging successfully.

Criteria that demand older adults to experience no resource losses to be considered as
aging successfully have been especially criticized. Neugarten (1974/1996b) summarized this
critique with her question, “Shall we accept the prevailing paradox that the successful ager is he
who does not age at all?” (p. 324). Consequently, other researchers have recognized the role of
the objective environment for successful aging and the considerable interindividual variability in
patterns of successful aging (e.g., Garfein & Herzog, 1995; Lawton, 1983; see also Scheidt,
Definition of Successful Aging

Successful aging needs to be defined with respect to personal and environmental aspects, dynamic criteria, and subjective as well as objective criteria (cf. M. M. Baltes & Carstensen, 1996, 2003; P. B. Baltes & Baltes, 1990; Featherman et al., 1990; Freund & Riediger, 2003; Lawton, 1983).

Conceptualizations of the successful ager also increasingly moved away from investigating static endpoints to studying dynamic processes that are associated with successful aging (M. M. Baltes & Carstensen, 1996, 2003; P. B. Baltes & Baltes, 1990; Brandstädter, 2002; Featherman et al., 1990; Kahana & Kahana, 1996; Schulz & Heckhausen, 1996; Steverink et al., 1998). The very process of interacting with one’s environment in a way that helps the individual to adapt to the challenges posed by aging (e.g., deteriorating health and resource loss) can be seen as an avenue to success. Consequently, successful aging has also been defined in terms of responding with resilience to the challenges associated with aging, reestablishing a good person-environment fit, or achieving a favorable balance of gains and losses (M. M. Baltes & Carstensen, 2003; P. B. Baltes & Baltes, 1990; Featherman et al., 1990; Thomae, 1983, 1990). But before the process or “how to” aspects of successful aging are introduced in more detail, let us consider how the elderly think about successful aging and what the term means to them.

Lay conceptions of successful aging. Considering the subjectivity of the term “success,” it is of interest to identify older people’s idiosyncratic definitions and perceptions of aging successfully. In line with the proposed criteria of successful aging, older people mentioned health and activity most frequently in their definitions of successful aging, followed by personal growth and happiness or contentment. Participants further mentioned personal relationships, independence, appreciation of life, and longevity (Knight & Ricciardelli, 2003). Thus, older persons themselves seem to consider successful aging as involving all components of the teleonomic model of well-being rather than focusing on high well-being or satisfaction. Nevertheless, when asked about the distinction between life satisfaction and successful aging, older people did not perceive much difference between the concepts. Their responses suggested, however, that life satisfaction was viewed as a precursor to successful aging: Success requires being satisfied (Fisher, 1995).

The relational model of plasticity reconsidered. Thus far, we can conclude that successful aging is a multidimensional construct that includes health, subjective well-being, and active engagement with life. Each study that focuses on only one aspect of successful aging neglects other important aspects. A “best” criterion for successful aging cannot be identified. Rather, different criteria show different developmental trajectories and different intercorrelations with other variables. Furthermore, indicators of successful aging may show complex interactions (cf. Staudinger & Freund, 1998; Staudinger et al., 1999) that are overlooked when employing an overall indicator of
successful aging. Solutions to the criterion problem inherent in the study of successful aging include the conceptualization of successful aging as a process rather than an outcome and the claim to specify criteria depending on one’s research question rather than to propose a single conceptualization of successful aging (cf. Freund & Riediger, 2003).

The concepts of resilience and successful aging overlap to a large extent during old age: Both specify processes of maintaining or regaining high levels of functioning across a number of life domains. Not surprisingly then, the definition and specification of resilience poses problems similar to those identified with regard to successful aging (cf. Staudinger & Greve, 2001; Staudinger et al., 1995). In B2, the relational model of resilience (Staudinger & Greve, 2001; Staudinger et al., 1993, 1995) has been introduced as a solution to the problem of how to define and study resilience. It has been further suggested that this model be considered in a more general vein as a relational model of plasticity, which includes resilience and also growth-oriented forms of plasticity. This general plasticity model (Figure 2, p. 10) can be employed to study the gains and losses occurring during old age and their relation to pathological, normal, and successful aging.

Within the relational model of plasticity, major criticisms of the successful aging concept are taken into account. Successful aging is not viewed as a personal disposition but rather as a match between a person’s needs and resources and developmental demands and challenges. The role of the environment is represented through both demands posed by the environment and resources provided by the environment. The heterogeneity, multidimensionality, and dynamic nature of successful aging is illustrated by the interactions between different parts of the model. Thus, the relational model of plasticity matches very well with the definition of successful aging from a transactional view, namely that “successful aging is a social psychological, processual construct that reflects the always-emerging, socially esteemed ways of adapting to and reshaping the prevailing, culturally recognized conditions of mind, body, and community for the elderly of a society” (Featherman et al., 1990, p. 52).

Personal life investment, functional health, and subjective well-being can all be considered as indicators of successful aging. As this study focuses on the interaction between those indicators, however, cognitive aspects of well-being (satisfaction with one’s life and aging) will be considered as indicative of a desirable state of development (Figure 2). Most aging individuals will eventually fail to prevent disease and disability or to keep active. A sense of satisfaction with one’s aging or life overall, however, can possibly be maintained until one’s dying day. Rather than expecting all individuals to be in good functional health, to report high PLI, and to be satisfied, success will be defined in terms of maintaining a sense of satisfaction even in adverse circumstances. Declining functional health is considered as one of the adversities that pose a challenge
to a sense of satisfaction. The role of PLI in contributing to and protecting high levels of satisfaction is of central interest in this study. PLI is expected to moderate the impact of declining functional health on life satisfaction and aging satisfaction.

It may have become evident that Figure 7 is also an illustration of some aspects of the plasticity model—one that is specifically tailored to the present study. The developmental impact of resource losses, specifically deteriorating functional health, during old age may or may not lead to reduced subjective well-being. If the individual is able to rearrange his or her goal hierarchy and adapt goal investment to the reduced resources, high levels of well-being can be maintained, as goal progress is still possible. If the individual tenaciously sticks to now unattainable goals, resource loss will have a negative impact on well-being. Different developmental models have dealt with the kind of processes illustrated in Figures 2 and 7 and identified the processes that contribute to successful aging or resilience. These models are now described.

2 Process Models of Successful Aging

Development consists of attempts to bring the environment into line with oneself and attempts to bring oneself into line with the environment. The balance between these outward-directed agentic and inward-directed yielding qualities of development changes across the life span. During old age increasing biological and social challenges limit active attempts at changing the environment and put a premium on the yielding qualities of development (Brandtstädter, 2002; J. Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1996). Successful aging has been described as the process of successfully adapting to this changing balance, thereby maximizing developmental gains and minimizing developmental losses (M. M. Baltes & Carstensen, 1996; P. B. Baltes & Baltes, 1990; Featherman et al., 1990). Three models that describe how this maintenance of optimal functioning can be achieved are now be introduced.

*The model of assimilative and accommodative coping* (Brandtstädter, 2002; Brandtstädter & Greve, 1994; Brandtstädter & Renner, 1990; Brandtstädter, Wentura, & Rothermund, 1999) accounts for successful adaptation in terms of two antagonistic processes through which personal goals are adjusted to changing action resources over the life span. In the assimilative mode, the actual situation is changed in accordance with personal goals; in the accommodative mode, personal goals are adjusted to the actual situation. During one coping episode the two processes, although antagonistic, complement each other: People at first try to tenaciously maintain goals even against obstacles and compensate for drawbacks. If these efforts do not succeed, goals will eventually be adjusted to irreversible constraints and action resources will be channeled to new
goals. Self-reported dispositional assimilative persistence and accommodative flexibility exhibited opposite relations to age. With increasing age, people reported more accommodative and less active-assimilative modes of coping (Brandstätter & Baltes-Götz, 1990; Brandstätter & Renner, 1990). Compensatory efforts, one aspect of assimilative coping, were found to increase up to age 70 and decline thereafter (Rothermund & Brandstätter, 2003). Furthermore, accommodative flexibility was found to serve two important functions. First, in people who were able to flexibly adjust goals, dissatisfaction or lack of success with respect to one particular life domain or goal spread or generalized less easily to their global sense of well-being (Brandstätter, 2002; Brandstätter & Renner, 1990). Second, accommodative flexibility was found to buffer the negative effects of age-typical losses and impairments (Brandstätter, 2002; Brandstätter & Rothermund, 1994, 2002; Brandstätter, Wentura, & Greve, 1993; Rothermund & Brandstätter, 2003).

The model of optimization in primary and secondary control (OPS model) builds on two conceptually orthogonal types of strategies: Selection and compensation on the one hand, and primary and secondary control on the other hand (J. Heckhausen, 1999, 2002; J. Heckhausen & Schulz, 1993, 1998). The management of selectivity and the compensation for failure experiences are two basic requirements of effective human behavior. Individual development means realizing only one developmental path among an infinity of possible developmental paths. Along this path, experiences of failure are inevitable and can help to acquire skills and solve problems as long as they do not undermine global personal control beliefs or continued engagement with life. That is, failure experiences need to be compensated for to maintain the individual’s motivational resources for future action.

Primary and secondary control specify another pair of processes that represent the agentic and yielding qualities of development. Primary control is directed at changing the external world and secondary control is directed at internal processes and serves to focus and protect motivational resources needed for primary control (J. Heckhausen & Schulz, 1995; Rothbaum, Weisz, & Snyder, 1982). The integration of the two dimensions of selection versus compensation and primary versus secondary control leads to the identification of four strategies in developmental regulation: selective primary control, compensatory primary control, selective secondary control, and compensatory secondary control (J. Heckhausen, 1999, 2002; J. Heckhausen & Schulz, 1993, 1998). Primary control strategies usually involve action that aims at attaining goals. Thereby, selective primary control specifies goal pursuit under circumstances where one’s own action resources suffice, while compensatory primary control is necessary when the given internal resources prove insufficient to attain the goal. Secondary control strategies involve more cognitive processes than overt actions (J. Heckhausen & Schulz, 1995). Selective secondary control
serves to keep the individual’s attention and effort focused on the current goal, and to prevent distractions by competing goals. Compensatory secondary control is essential to buffer the potential negative effects of failure and hence promotes the long-term potential for primary control. It involves disengagement from blocked goals and self-protective attributions and social comparisons.

Within the OPS model, the definition of adaptive human functioning or, more specifically, successful aging rests on the position that primary control holds functional primacy over secondary control (J. Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1996). Development or aging is successful insofar as it promotes and maintains long-term primary control potential. And this is where the process of optimization comes in. Optimization is conceptualized as a higher-order process that regulates the four control strategies so as to enhance and protect primary control potential (e.g., J. Heckhausen, 1999; J. Heckhausen & Schulz, 1998). Three general principles help to understand the functioning of optimization. First, optimization means selecting appropriate goals, that is, goals that make the best use of developmental ecologies. Second, optimization implies maintaining some diversity among possible goals or developmental paths. Without variability there is not much opportunity for selection. Third, optimization involves the management of trade-offs across domains and life phases.

Empirical studies on primary and secondary control revealed that older adults more frequently used compensatory secondary control strategies than younger adults (Wrosch & Heckhausen, 1999; Wrosch, Heckhausen, & Lachman, 2000). Results on the development of primary control are somewhat inconsistent. Stability (J. Heckhausen, 1997) and also increases (Wrosch et al., 2000) in primary control with increasing age have been observed. Moreover, primary control striving was shown to be adaptive particularly in young adulthood and midlife, but lost its adaptivity during later life. Secondary control strategies, in contrast, became more adaptive (Wrosch et al., 2000). In reacting to stress, the selection of control strategies that are tailored to one’s present opportunity structures assumes a crucial role for maintaining subjective well-being. For older people who experienced health or financial stress compensatory secondary control strategies, but not primary control strategies, were positively related to subjective well-being. For younger adults who similarly experienced health or financial stress both primary and secondary control striving were conducive to well-being (Wrosch et al., 2000). When contrasting the impact of potentially controllable acute health problems and uncontrollable chronic disease on depressivity in older adults, a similar finding emerged. With acute health problems primary control strategies helped to prevent depressive symptoms. Persons with chronic disease, however, were able to avoid depressive symptoms by using compensatory secondary control (J. Heckhausen, 2002).
The model of selection, optimization, and compensation (SOC model) describes successful aging as resulting from the dynamic interplay between the processes of selection, optimization, and compensation (M. M. Baltes & Carstensen, 1996; P. B. Baltes, 1997; P. B. Baltes & Baltes, 1990; Freund & Baltes, 2000; Freund, Li, & Baltes, 1999; Marsiske, Lang, Baltes, & Baltes, 1995). Selection refers to setting goals. The identification of and commitment to a subset of goals is denoted by the process of elective selection (ES), while loss-based selection (LBS) entails reconstructing one’s goal system in response to loss. Optimization (O) is focused on acquiring and investing goal-relevant means during goal pursuit, while compensation (C) occurs in reaction to losses in goal-relevant means and involves the use of alternative means to maintain a given level of functioning. With increasing age, which means diminishing resources and increasing losses, selection, optimization, and compensation gain special importance (M. M. Baltes & Carstensen, 1996; P. B. Baltes & Baltes, 1990). On the one hand, use of SOC should be enhanced to counteract losses in resources and functioning. A wealth of accumulated life experience may thereby help to further improve the efficient use of SOC strategies. On the other hand, use of SOC itself requires resources and functional capacity (Freund & Baltes, 2002). Moreover, the rule “more is better” does not apply to the SOC strategies. Being overly selective, investing tenaciously in failing courses of action, or trying to compensate at any cost are all instances of maladaptive behavior (Freund & Baltes, 2000; Freund et al., 1999).

Several empirical studies provided support for the SOC model. Self-reported use of SOC strategies was found to increase up to late midlife and decrease thereafter. More specifically, O, C, and LBS showed the described quadratic pattern, whereas ES increased until the third age and was stable thereafter (Freund & Baltes, 1998, 2002). Comparing the results in terms of goal setting, that is, ES and LBS, and goal striving, that is, O and C (Freund et al., 1999), we see that goal setting strategies are least frequently endorsed by younger adults, increase up to midlife, and show only minimal or even no decline in old age. In contrast, goal striving strategies are strongly endorsed by younger adults, again peak in midlife, and subsequently show marked declines in old age. Age-associated limitations of resources thus impact most heavily on the more agentic behaviors of O and C, and show less impact on the more cognitive and less resource-demanding strategies of ES and LBS.

At all ages, however, use of SOC was associated with higher levels of positive affect and psychological well-being (Freund & Baltes, 1998, 2002). As would be expected, O and C further demonstrated high associations with assimilative coping and weaker associations with accommodative coping. ES and LBS revealed positive, but relatively small, relations to assimilative and accommodative strategies.
Support for the SOC model was also obtained with behavioral indicators (e.g., Freund et al., 1999; Lang et al., 2002; K. Z. H. Li, Lindenberger, Freund, & Baltes, 2001). In a dual-task paradigm, older adults as compared to younger adults prioritized walking over memorizing words. As older adults are especially vulnerable regarding falls this selective focus on walking performance seems highly adaptive. Older adults were also more effective in using a compensatory strategy (use of a handrail) to maintain walking performance (K. Z. H. Li et al., 2001). In another study, the availability of sensorimotor, cognitive, personality, and social resources was found to facilitate the use of SOC strategies with regard to everyday activities during old age (Lang et al., 2002). Resource-rich older people selectively invested in spending time with their family and became more selective with regard to leisure activities. They also increased compensatory efforts as indicated by an increase in the number and duration of sleep phases during the day, which may help to regenerate resources. Resource-poor older adults did not show these adaptive changes.

Summary of introduced models and conclusions with regard to PLI development. Although the models just discussed are different from each other in several respects, it is possible to identify a number of common assumptions. First, in order to age successfully or maintain a favorable balance of gains over losses it is crucial to more strongly rely on the yielding qualities of self-regulation or development. The empirical evidence consistently demonstrated increases in accommodative coping, secondary control, and other flexible self-regulatory strategies, such as emotion-focused coping (Brandtstädter & Renner, 1990; Diehl, Coyle, & Labouvie-Vief, 1996; Folkman, Lazarus, Pimley, & Novacek, 1987; Wrosch & Heckhausen, 1999; Wrosch et al., 2000). In contrast, evidence on changes in agentic qualities of development like assimilative coping, primary control, or problem-focused coping is inconsistent. Decline, stability, and increase have been reported (Brandtstädter & Renner, 1990; Folkman et al., 1987; J. Heckhausen, 1997; Wrosch et al., 2000). Second, limited resources for goal pursuit require more selective investments. As the process of selection does not demand many resources, it can be employed by even the oldest old. The potential to optimize and compensate in the process of goal pursuit diminishes, however. This pattern of findings again suggests that personal life investment becomes more selective during old age (as has been mentioned before). More specifically, investment in less central or optional domains is reduced in order to maintain investment in obligatory domains. Nevertheless, it has also been emphasized that it is crucial to avoid the dangers of overselection or lack of diversity (e.g., Freund et al., 1999; J. Heckhausen, 1999). At any age, development proceeds by selecting among a number of alternative developmental pathways. If no possible paths are left, further development is impaired. The need for diversity is not equally pressing during old and very old age as during earlier phases of the life span, but it is an open question whether even the oldest old
are vulnerable to the negative effects of overselection. Third, increasing reliance on assimilative coping, secondary control, or selection strategies during old age implies a shift in the balance between overt action and thought. The yielding self-regulatory strategies, for the most part, recruit cognitive processes, such as choosing, planning, comparison processes, or redefinition of situations and goals. The higher prevalence of those strategies is therefore suggestive of a shift between the action and thought components of personal life investment ratings. Engagement with personal goals may be expressed more in terms of thought processes rather than overt action.

3 The Relationship between Subjective Well-Being, Health, and Personal Goals and Activities

One central aim of this study is to investigate the moderating role of personal life investment on the impact of health constraints on subjective well-being. The assumed functional relations between health (as a resource indicator), goal investment, and subjective well-being have already been discussed (Figure 7). In this section, empirical findings on the interrelations between the three constructs are reported that provide further support for the model. However, most studies have focused on only two of the three variables and made no attempt to study processes of mediation or moderation. For that reason, findings on the association between two of the three variables, that is, between health and subjective well-being, health and goal striving, and goal striving and subjective well-being are first summarized. Thereby, various health indicators are considered, that is, objective health, functional health, and subjective health. As subjective health data are much easier to collect than objective health data, many studies involve only subjective indicators. Where possible, differences between findings with subjective and objective indicators are highlighted. Furthermore, the question of whether the reported associations between pairs of variables are similar or different when goals and activities in life domains classified as obligatory or optional are compared is addressed. After that, the few studies on moderating effects involving all three variables are introduced.

Health and subjective well-being. Across a large number of studies, health status has emerged as a leading covariate of life satisfaction and subjective well-being (Larson, 1978; Markides & Martin, 1979; Okun, Stock, Haring, & Witter, 1984; Pinquart, 1998; Smith et al., 1999). However, in order to understand the relationship between health and well-being this global statement needs further qualification. Health status can be assessed in terms of subjective health and objective health. Subjective health is most often measured with a single global self-rating of one’s health (from poor to excellent). Objective health can be differentiated into physical health (presence or
absence of acute and chronic diseases or risk factors for disease), functional health (degree of functioning in everyday life or competence that is permitted under present health conditions), and mental health (presence or absence of psychiatric diagnoses; cf. Helmchen et al., 1999; R. J. Johnson & Wolinsky, 1993; Liang, 1986; Pinquart, 2001b; Steinhagen-Thiessen & Borchelt, 1999). A recent meta-analysis (Pinquart, 2001b) demonstrated that subjective health ratings are associated with physical, functional, and mental health. The strongest association was found between subjective health and measures of physical health. Moreover, the correlations of subjective health with physical and functional health were lower in older (mean age over 75 years) as compared to younger (mean age 60 – 75 years) samples. Subjective health perceptions thus reflect objective health status to a certain degree but they cannot be considered as a proxy of objective health (Pinquart, 2001b).

Subjective health was found to be more strongly linked to subjective well-being than objective health (Larson, 1978; Okun et al., 1984; Smith, Borchelt et al., 2002; Smith et al., 1999). Objective health status had only indirect effects on subjective well-being, that is, the effects of objective health on well-being were mediated by subjective health perceptions. Thus, the effects of change in objective health on subjective well-being seem to be cushioned by the person’s interpretation of change (Smith et al., 1999). Nevertheless, when subjective evaluations were not considered as mediators, positive zero-order correlations between objective health and subjective well-being have been found. In a meta-analysis (Pinquart & Sörensen, 2000), mean correlations in the .20 range between functional health and indicators of subjective well-being have been reported. Associations were somewhat smaller if single-item measures rather than multiple-item scales were used to assess well-being.

The predictive power of objective and subjective health also varies across different indicators of subjective well-being. Considered together, health indicators were found to account for 20% of the variance in life satisfaction, 18% in depressivity, 14% in negative affect, and 13% in positive affect. The largest portion of variance (32%) was explained in the domain-specific indicator of satisfaction with one’s aging (Smith, Borchelt et al., 2002). Deteriorating health thus is most closely related to dissatisfaction with aging, followed by life satisfaction. The relationship with affective components of well-being is a little smaller.

The relationship between health and subjective well-being cannot be considered as a one-way street, however. The influence of health on well-being is most often studied, but still, subjective well-being or a positive outlook on life may also increase one’s health or longevity. For instance, higher subjective well-being was found to be associated with a reduced mortality risk after statistical controls for age, sociodemographic characteristics, and health measures. Spe-
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Specifically, dissatisfaction with aging turned out as a risk factor for mortality in addition to higher age, poor health, and impaired intellectual functioning (Maier & Smith, 1999).

Health, goals, and activities. Age-related changes in personal goals and activities have already been discussed (cf. D3). As higher age can be considered a proxy for lower subjective and objective health, these findings can also be interpreted as pointing to possible associations between subjective and objective health and goals and activities. With increasing age, fewer goals are reported (Cross & Markus, 1991; Hooker, 1992; Parks et al., 1988). Goals related to one’s health, physical functioning, independence, and death become more prominent, while leisure and work-related goals become less prominent with higher age (Hooker & Siegler, 1993; Frazier et al., 2000; Frazier et al., 2002; Smith & Freund, 2002; Staudinger et al., 1999). The overall goal focus shifts towards maintenance and loss-regulation (Dittmann-Kohli, 1995; Freund & Ebner, in press; Katzko et al., 1998; Ogilvie et al., 2001; Smith & Freund, 2002; Staudinger et al., 1995).

However, only some studies have directly investigated the association between subjective, objective, or functional health and personal goals or activities in old age (e.g., M. M. Baltes et al., 1990; Frazier et al., 2000; Frazier et al., 2002; Hooker & Siegler, 1993; Horgas et al., 1998; Lapierre et al., 1993, 1997; Markides & Martin, 1979; Pushkar et al., 1997; Smith & Freund, 2002; Verbrugge et al., 1996), and not all of these studies found systematic associations (e.g., Frazier et al., 2000; Smith & Freund, 2002). Low functional health and low subjective health were associated with more goals related to health and death (Frazier et al., 2002; Lapierre et al., 1993, 1997). Better subjective health was associated with higher importance of and greater achievement in the recreational domain (Hooker & Siegler, 1993). Low subjective health was further associated with reduced activity (Markides & Martin, 1979). With increasing functional impairments, people engaged more in passive activities and activities that are necessary to maintain independent living and engaged less in physically demanding or productive activities (M. M. Baltes et al., 1990; Horgas et al., 1998; Pushkar et al., 1997; Verbrugge et al., 1996).

Here again, we need to consider that goals and activities can also have an impact on health status. Activity level, measured in terms of the number of activities people engage in or the frequency with which they engage in different activities, has been shown to be positively related to functional and subjective health (Everard, Lach, Fisher, & Baum, 2000; Holahan, 1988). Still, the causal relations between activity and health remain somewhat unclear. A longitudinal study by Menec (2003) showed that engaging in social and productive activities is related to reduced functional decline and lower mortality. The role of social and leisure activities in enhancing survival of older people was also demonstrated in studies by Lennartsson and Silverstein (2001) and Klumb and Maier (2002). An earlier longitudinal study, however, failed to demonstrate predictive relationships between activity engagement and functional health or mortality (Lee &
Markides, 1990; Markides & Lee, 1990). The question of what mechanisms underlie the relation between activity, health, and mortality remains unresolved. As most of the studied activities have a physical component, the positive effect of activity on health and survival may be attributed to the benefits of being physically active, which have previously been documented (e.g., Kaplan, Strawbridge, Cohen, & Hungerford, 1996; Kujala, Kaprio, Sarna, & Koskenvuo, 1998; Takkinen, Suutama, & Ruoppila, 2001). However, it has also been suggested that a psychosocial pathway links daily activities and survival: Social and leisure activities can enhance the perceived quality of life, which is positively related to mental and physical health and, ultimately, survival (Klumb & Maier, 2002).

**Goals, activities, and subjective well-being.** Personal goals have been identified as crucial to a person's sense of well-being (e.g., Brunstein, Schultheiss, & Maier, 1999; Emmons, 1996, 2003; King, Richards, & Stemmerich, 1998; Lecci et al., 1994; Omodei & Wearing, 1990; Palys & Little, 1983; Schmuck & Sheldon, 2001). This global observation also holds true for older adults. Continuity in personal goals and goal striving has been found to be associated with better adjustment to retirement, that is, higher leisure quality and higher life satisfaction (Robbins, Lee, & Wan, 1994). Self-assessments of the attainability of personal goals were positively related to subjective well-being in a sample of older adults (Brunstein, 1999). Furthermore, striving for future meaning and holding positive expectations concerning one's future were conducive to higher well-being among young-old and old-old persons (Reker et al., 1987). However, striving for primary control or active improvement of one’s situation loses its positive impact on subjective well-being during old age, while use of self-protective secondary control processes or attempts at maintenance gain in importance for high well-being (e.g., Rapkin & Fischer, 1992a; Smith & Freund, 2002; Wrosch et al., 2000).

Several goals or goal domains have been found to be associated with higher well-being in older people: Involvement in goals related to social contact or the well-being of others and leisure, achievement, or productive activity showed positive relations to emotional well-being and life satisfaction (Holahan, 1988; Lapierre et al., 1997). Here, goal achievement rather than goal importance proved to be crucial for life satisfaction: Achievement in work- and recreation-related goals, but not the perceived importance of these goals, contributed to life satisfaction (Hooker & Siegler, 1993). In contrast, goals related to one's health, reducing activity because of health concerns, disengagement, or having a good death were conducive to dissatisfaction (Lapierre et al., 1997; Rapkin & Fischer, 1992a). Striving for autonomy (e.g., being self-sufficient, remaining independent, healthy, and financially secure) was unrelated to emotional well-being and satisfaction (Holahan, 1988; Lapierre et al., 1997). Furthermore, developing health-related fears
during old age was related to declining life satisfaction and aging satisfaction (Smith & Freund, 2002).

In line with the activity theory of aging (Havighurst, 1961; Havighurst et al., 1968; Lemon et al., 1972; Maddox, 1965), level of activity or activity participation has been related to subjective well-being in old age. Overall levels of activity participation were associated with higher life satisfaction or emotional well-being (Harlow & Cantor, 1996; Holahan, 1988; Markides & Martin, 1979; Menec, 2003). The positive effects of activity level can be reduced to a number of specific activities, however. Social participation, community service, and leisure activities, for instance, sports, handwork hobbies, travel, cultural activities, or reading and television watching, demonstrated positive relations to life satisfaction, happiness, or lack of depressivity (Harlow & Cantor, 1996; Herzog, Franks, Markus, & Holmberg, 1998; Menec, 2003; Takkinen et al., 2001). Further, quantity of social contact with friends was related to subjective well-being. And this association was shown to be much higher than the association between contact with family members and well-being (Pinquart & Sörensen, 2000; see also Larson, Mannell, & Zuzanek, 1986; Lemon et al., 1972). Sexual activity is also frequently held to enhance psychological well-being in the elderly. However, empirical results revealed that lack of sexual activity is not associated with reduced well-being (cf. Furchtgott, 1999). Evidence on the relation between the cognitive activity of life reflection and subjective well-being is equivocal (Haight & Hendrix, 1995; Hendrix & Haight, 2002; see also Staudinger, 2001). For instance, successful and unsuccessful agers did not differ in the total amount of thinking about their lives but rather in their achievement of integrity through life review (Wong & Watt, 1991). Thus, global measures of energy and effort devoted to life reflection most likely will be unrelated to well-being.

**Goals and activities in obligatory and optional life domains show differential relationships with health and subjective well-being.** The overall picture of the relationships between goals, activities, subjective, objective, and functional health, and well-being can be summarized along the lines of obligatory and optional investment. Poorer subjective or functional health is associated with an increasing number of goals and activities in obligatory PLI domains like one’s health, independence, or death (Frazier et al., 2002; Lapierre et al., 1993, 1997). This investment in obligatory domains is mostly unrelated or even negatively related to well-being (Holahan, 1988; Lapierre et al., 1997; Rapkin & Fischer, 1992a; Smith & Freund, 2002). Specifically, negative associations between health goals and death-related goals and satisfaction have been documented (Lapierre et al., 1997; Smith & Freund, 2002). However, no test was done to see whether this association can be attributed to the effects of deteriorating health: Deteriorating health may be linked to an increasing number of goals focused on health or dying and simultaneously decreasing satisfaction.
People in poor subjective health or poor functional health are less engaged in goals and activities in optional PLI domains like leisure or occupation (e.g., Hooker & Siegler, 1993; Horgas et al., 1998). Pursuing goals and activities related to optional domains is conducive to higher levels of subjective well-being (e.g., Holahan, 1988; Hooker & Siegler, 1993; Lapierre et al., 1997). Those findings suggest that aging, to the degree that it involves declines in health status, is related to more obligatory activities, fewer optional activities, and lower subjective well-being. Nevertheless, many of the reported studies focused on cross-sectional relations among pairs of variables rather than on processes involved in the adaptation to aging. In cross-sectional studies the direction of influence postulated between goals, health, and well-being is somewhat arbitrarily determined. In order to understand the interplay of goal investment, health, and well-being, we need to simultaneously consider all of these variables and also their interactive effects. The few studies that have taken into account interactive effects have found evidence for the important role of self-regulatory constructs in moderating the impact of deteriorating health (or increasing age) on one’s sense of well-being (Brandtstädter et al., 2003; Rothermund & Brandtstädter, 2003; Staudinger & Fleeson, 1996; Staudinger et al., 1999).

The moderating role of investment, goals, and activities on the relationship between health (or age) and subjective well-being. Process models of successful aging (cf. E2) have highlighted the necessity to adapt to irreversible losses during old age. A central aspect of this yielding to the inevitable is to stop investing in goals and activities that are no longer feasible, although those goals and activities may once have contributed to one’s sense of well-being and meaning in life. Simultaneously, older people need to prevent falling into despair and disengaging from life altogether. If we want to understand how relatively high levels of well-being can be maintained under given developmental circumstances, we need to move away from investigating only linear relationships between variables to considering interactive effects (cf. Staudinger & Freund, 1998; Staudinger et al., 1999). Then, we are likely to find that “one size does not fit all.”

Analyses of the cross-sectional BASE data demonstrated moderating effects of average personal life investment on the relationship between objective health and well-being (Staudinger & Fleeson, 1996; Staudinger et al., 1999). For participants who kept investing at high levels, physical constraints were negatively related to emotional well-being and aging satisfaction. In contrast, physical constraints lost most of their negative impact on well-being at lower levels of average PLI. Thus, under conditions of severe health constraints reduced average PLI can be considered a protective mechanism of the aging self.

Other studies also demonstrated the adaptivity of giving in to developmental constraints. In a sample of older adults, Brunstein (1999) found that high commitment to personal goals was conducive to higher subjective well-being only under conditions favorable for goal attainment.
Under conditions of low goal attainability, higher commitment was associated with lower well-being. In contrast, for older persons who reported low commitment to personal goals, goal attainability played only a minor role for subjective well-being.

Brandtstädter and others (2003) showed that action resources (as indicated through higher functional capacity, independence, and positive social relations) were conducive to higher perceived quality of life, while meaning resources (as indicated through life reflection, finding meaning in life, and faith) were unrelated to perceived quality of life. With increasing age, however, action resources were found to be less conducive to subjective life quality, while meaning resources gained in importance and were positively associated with subjective life quality in old-old individuals. Moreover, the availability of action resources moderated the relationship between meaning resources and perceived quality of life. In persons with many action resources, meaning resources were negatively related to subjective life quality; in persons with few action resources, meaning resources were positively related to subjective life quality.

Finally, age was found to moderate the association between compensatory efforts and perceived developmental deficits and losses in a longitudinal study (Rothermund & Brandtstädter, 2003). Increasing efforts to actively compensate for decrements in ability and performance were associated with decreases in perceived deficits among young-old participants. For old-old participants increases in compensatory efforts had an adverse effect on perceived deficits and losses: The more they increased compensatory efforts the more losses they perceived. Rather than trying to compensate for losses, the adjustment of personal performance standards helped old-old individuals to maintain contentment with their performance (Rothermund & Brandtstädter, 2003).

In sum, with increasing age and declining functional capacity, life satisfaction and well-being become less dependent on being highly active and engaged with life but rather on selectively reducing investment, readjusting standards, reviewing one’s life overall, and finding meaning (cf. E2, E3; see also Staudinger, 2001). While reducing average PLI or optional PLI seems premature during the third age, when most people are still relatively well-functioning, reducing average and optional investment is proposed to be adaptive during the fourth age. The negative impact of highly adverse developmental changes on well-being during the fourth age most likely cannot be completely offset by changes in PLI. Still, concentrating on the essential obligations during very old age and disengaging to some extent from more optional pursuits may help to protect at least moderate levels of well-being. These general considerations are now specified in a last set of hypotheses.
4 Hypothesized Functionality of Personal Life Investment for Successful Aging

The relational model of plasticity (Figure 2, p. 10) and the more specific teleonomic model of subjective well-being (Figure 7, p. 98) were introduced as heuristic tools to conceptualize and study development in context. An important developmental impact during old age is losses in physical and cognitive resources. As outlined above, successful aging is best conceptualized in terms of process models that specify how older individuals can maintain high levels of subjective well-being in spite of these losses. To understand the relevant processes, resources (e.g., functional health status), investment in personal goals, and subjective well-being need to simultaneously be considered and linked. As illustrated in the relational model of plasticity and the teleonomic model of well-being, goals and goal investment have to be adapted to changes in one’s available resources to ensure that important goals can still be attained and, as a result, high levels of well-being can be maintained.

In this study, functional health, personal life investment, and a more cognitive aspect of well-being, namely, satisfaction are employed as indicators of central components of the teleonomic model of well-being. For this study, two indicators of satisfaction were chosen: Life satisfaction as a global indicator and aging satisfaction as a more domain-specific indicator that is of high relevance during old age. Aging satisfaction was found to be especially vulnerable to the effects of deteriorating health (Smith, Borchelt et al., 2002). It may thus be easier to demonstrate the hypothesized associations with this more specific indicator of satisfaction.

The analyses in this third and last major part of the study are again based on longitudinal data. That is, predictions can be made with regard to the initial levels of PLI, functional health, and satisfaction and also with regard to changes in PLI, functional health, and satisfaction. Please note that this third part focuses on self-regulatory processes on the individual level. That is, although the four PLI facets are expected to show no mean level change across time in BASE (hypotheses 2d – 2g), I expect to find variability in change patterns: Some people reduce PLI, some do not change PLI, and some may even increase PLI. Initial levels of and changes in a variable are considered in the analyses if the relevant variable shows significant interindividual variability in both levels and changes. If no variability in change is detected, only initial levels are used. In general, the predictions regarding the relationships between initial levels and between changes are identical.

Low functional health is a risk factor to activity engagement as it implies limitations in everyday functioning. It has been chosen as a central indicator of the developmental context of older adults as its impact on PLI can be expected to be stronger than the impact of other health indicators, such as number of diagnoses. Simultaneously, low functional health is a risk factor to life satisfaction and aging satisfaction (cf. E3). As this connection is already well established it was
not specified as a hypothesis to be tested. It is expected that both levels of and changes in average PLI, PLI selectivity, and optional PLI are related to level of and change in functional health. The predicted associations between PLI and health are specified in hypothesis 3a: *Optional PLI and average PLI are positively related, PLI selectivity is negatively related, and obligatory PLI is unrelated to functional health.* This hypothesis can now be spelled out in terms of associations between levels and associations between changes. Initial levels of optional PLI and average PLI are positively related, initial level of PLI selectivity is negatively related, and initial level of obligatory PLI is unrelated to initial level of functional health. With declining functional health, optional PLI and average PLI also decline, PLI selectivity increases, and obligatory PLI remains unchanged. It could be expected that investment in the health domain, and hence overall obligatory PLI, increases with declining functional health. However, participants in the cross-sectional study already reported levels of health PLI that can hardly be increased, that is, there is a ceiling effect for health investment in old age (Staudinger et al., 1999).

Parallel to the suggested associations with health, hypothesis 3b states that *optional PLI and average PLI are positively related, PLI selectivity is negatively related, and obligatory PLI is unrelated to life satisfaction and aging satisfaction.* Or more specifically, initial levels of optional PLI and average PLI are positively related, initial level of PLI selectivity is negatively related, and initial level of obligatory PLI is unrelated to initial levels of life satisfaction and aging satisfaction. Declining life satisfaction and declining aging satisfaction are associated with declining optional PLI, declining average PLI, increasing PLI selectivity, and no change in obligatory PLI. Goals and activities in some obligatory life domains were found to be unrelated or negatively related to satisfaction (cf. E3). The documented negative associations, however, may be due to the impact of deteriorating health that leads to both a higher number of goals and activities in the respective obligatory domains and reduced satisfaction. Moreover, obligatory PLI comprises forms of investment that may reduce satisfaction but also investments that may increase satisfaction. The teleonomic model of well-being (Figure 7) helps to illustrate this point. Making progress toward goals classified as obligatory is expected to increase satisfaction. However, the obligatory nature of some goals also implies that those goals cannot easily be given up, even if resources are limited and attaining a goal is unlikely. For instance, a person with a terminal illness cannot completely stop investing in the health domain, although good health cannot be restored. Consequently, goal striving is not expected to contribute to higher satisfaction but merely helps to avoid even more distress or dissatisfaction. This situation is assumed to be typical of avoidance goals that are expected to often occur in life domains classified as obligatory (cf. C5).

More importantly, the described zero-order correlations are expected to be further qualified by interactions. The central interest of this last part of the analyses is not primarily the
direct relationships between PLI, health, and satisfaction but rather the moderating role of PLI on the relationship between health and satisfaction. Declining functional health poses a challenge to high levels of satisfaction. Satisfaction with one’s life or aging can only be maintained if the self-system reacts and adapts to this challenge. Reducing optional PLI is viewed as an adaptive reaction, that is, people do not fall into despair while trying in vain to stay engaged with optional life domains but rather they refocus investment. It is expected that limiting optional PLI, which also implies limiting average PLI and increasing PLI selectivity, is conducive to maintaining high levels of satisfaction in the face of declining functional health. Reduced PLI may not be able to completely offset the negative impact of poor health on satisfaction but it should buffer the impact of poor health.

Hypotheses on the moderating role of PLI are tested, again, first with regard to the initial levels of the respective variables and then with regard to the changes in the respective variables. The moderating role of average PLI on the relationship between health and satisfaction for the cross-sectional BASE sample has already been demonstrated (Staudinger & Fleeson, 1996; Staudinger et al., 1999). A similar moderating role has been found for an indicator of investment selectivity (Staudinger et al., 1999). Because this indicator is quite different from the PLI selectivity indicator used here (i.e., selectivity as the frequency of very low and low PLI scores rather than the standard deviation across the PLI domains), the results in this study will not necessarily be the same. Moreover, a slightly different functional health indicator is employed here.

It is hypothesized that the moderating role of levels of average PLI and PLI selectivity on the relationship between level of functional health and level of satisfaction can be demonstrated with the longitudinal BASE sample. Albeit some of the variables are slightly different, the previous results from the cross-sectional sample are expected to replicate. The level of optional PLI is further hypothesized to moderate the relationship between level of health and level of satisfaction in the longitudinal sample. Finally, changes in optional PLI, average PLI, and PLI selectivity are predicted to moderate the relationship between changes in functional health and changes in life satisfaction and aging satisfaction. That is, changes in health and satisfaction demonstrate higher positive correlations when optional PLI or, respectively, average PLI is not reduced or when PLI selectivity is not increased.

To sum up, it is predicted that **average PLI moderates the relationship between functional health and satisfaction**: Initial levels of health and satisfaction demonstrate stronger positive associations at higher levels of average PLI. Change in health and change in satisfaction demonstrate stronger positive associations when average PLI is not reduced (hypothesis 3c). Hypothesis 3d states that **PLI selectivity moderates the relationship between functional health and satisfaction**: Initial levels of health and satisfaction demonstrate stronger positive associations at lower levels of PLI selectivity. Change in health and change in satisfaction demonstrate stronger
positive associations when PLI selectivity is not increased. Further, it is hypothesized that optional PLI moderates the relationship between functional health and satisfaction: Initial levels of health and satisfaction demonstrate stronger positive associations at higher levels of optional PLI. Change in health and change in satisfaction demonstrate stronger positive associations when optional PLI is not reduced (hypothesis 3e). In contrast, it is expected that obligatory PLI does not moderate the relationship between functional health and satisfaction (hypothesis 3f). It is assumed that reducing obligatory PLI in response to resource loss is not adaptive in order to cope with loss. Obligations need to be met, no matter what the circumstances are.

However, obligatory PLI is expected to play a moderating role for the relationship between optional PLI and satisfaction: The functionality of optional PLI is assumed to depend on obligatory PLI (cf. B3, C5, D5). If one does not have enough resources to meet one’s obligations, it will not contribute to higher satisfaction if the few available resources are invested in optional pursuits. In contrast, if resources are sufficient to meet one’s obligations, investing the remaining resources in optional pursuits is assumed to contribute to higher satisfaction. Thus, it is predicted that obligatory PLI moderates the relationship between optional PLI and satisfaction: Initial levels of optional PLI and satisfaction demonstrate stronger positive associations at higher levels of obligatory PLI. Change in optional PLI and change in satisfaction demonstrate stronger positive associations when obligatory PLI is not reduced (hypothesis 3g).
THE PRESENT STUDY

This study is concerned with the nature and development of goal striving or, specifically, personal life investment in old age. Three major aims guide this study. The first aim is to validate the construct of personal life investment by showing systematic associations with other elements of the self-system, which operates when individuals try to compose their lives within a changing internal and external environment. The second aim is to study the late-life development of PLI. Finally, the third aim is to study the role of PLI for successful aging. Cross-sectional and longitudinal data from the Berlin Aging Study (BASE; P. B. Baltes & Mayer, 1999) are employed to accomplish these aims.

The previous chapters have illustrated that developmental contexts need to be taken into account when studying the nature and development of personal life investment in old and very old age. This is reflected in the four PLI facets considered in this study, which represent the average amount of energy invested in goal striving and the distribution of energy across life domains but also the impact of developmental contexts that dictate where older adults ought to invest energy and effort. Average PLI is a measure of motivational energy expended across all life domains, that is, a measure of engagement with life overall. PLI selectivity is a measure of the distribution of energy, that is, it indicates whether a person focuses her or his energy on a few selected life domains or distributes energy almost equally across life domains. Obligatory PLI represents investment in life domains that comprise life’s basic necessities or pose age-normative challenges to development. Health, cognitive fitness, family, independence, life reflection, and one’s death and dying have been identified as obligatory life domains during old and very old age. Optional PLI represents investment in life domains that do not pose age-normative challenges or are not very important during a specific age but can still contribute to higher subjective well-being, successful development, or a sense of self-actualization. The optional life domains during old age are leisure, friends, sexuality, and occupation.

The theoretical background pertaining to each of the three major aims of the study has been introduced in separate chapters (C, D, E). The four PLI facets have been related to other elements of the self-system (C). Their developmental trajectories were predicted on the basis of developmental changes in goals, self-concepts, and activities (D). Finally, the teleonomic model of well-being illustrated the functional role of goal investment for subjective well-being (and successful aging; E). In each of these sections, a set of specific hypotheses was derived. To aid comprehension of the analyses to follow, all hypotheses are again summarized in Table 3 and the reader is referred to the page where the hypothesis has been formulated.

For each major aim, variables and persons were selected from BASE so as to allow for the most valid test of predictions and to base the analyses on as much information as possible. In
order to validate PLI, the entire cross-sectional sample \((N = 516)\) is employed. As the primary interest here is in the relations between PLI and other elements of the self-system, longitudinal data are not required for hypothesis testing. Rather, it is important that the results may be generalized to the population of elderly Germans as far as possible. Cross-sectional data on extraversion and neuroticism, positive and negative affect, and internal control beliefs were selected to represent personality dispositions. Participants’ self-definitions and their hoped-for and feared selves are indicators of the current and possible self-concept. Finally, the reported activities of one day provide some information regarding participants’ daily activities.

Table 3
Summary of Hypotheses

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Validation of personal life investment</td>
<td></td>
</tr>
<tr>
<td>1a. Personality dispositions, current and possible selves, and daily activities are related to average PLI, obligatory PLI, and optional PLI. Current and possible selves and activities, but not personality dispositions, are related to PLI selectivity.</td>
<td>49</td>
</tr>
<tr>
<td>1b. Average PLI and obligatory PLI are positively related to both extraversion/positive affectivity and neuroticism/negative affectivity. Optional PLI is positively related to extraversion/positive affectivity but unrelated to neuroticism/negative affectivity.</td>
<td>53</td>
</tr>
<tr>
<td>1c. Openness is positively related to average PLI, obligatory PLI, and optional PLI.</td>
<td>53</td>
</tr>
<tr>
<td>1d. Internal control beliefs are positively related to average PLI, obligatory PLI, and optional PLI.</td>
<td>54</td>
</tr>
<tr>
<td>1e. The number of self-defining domains is positively related to average PLI and negatively related to PLI selectivity. The number of self-definitions in life domains classified as obligatory is positively related to obligatory PLI and the number of self-definitions in life domains classified as optional is positively related to optional PLI.</td>
<td>57</td>
</tr>
<tr>
<td>1f. The number of hoped-for possible selves is positively related to average PLI, obligatory PLI, and optional PLI and negatively related to PLI selectivity. The number of feared possible selves is positively related to average PLI and obligatory PLI, negatively related to PLI selectivity, and unrelated to optional PLI. Similarly, the numbers of both hoped-for and feared selves in life domains classified as obligatory are positively related to obligatory PLI but only the number of hoped-for selves in life domains classified as optional is positively related to optional PLI.</td>
<td>57</td>
</tr>
<tr>
<td>1g. The total duration of activity is positively related to average PLI and negatively related to PLI selectivity. Performing more activities classified as obligatory is positively related to obligatory PLI and performing more activities classified as optional is positively related to optional PLI.</td>
<td>62</td>
</tr>
</tbody>
</table>
2. Late-life development of personal life investment and relations between obligatory and optional PLI

2a. A small amount of mortality-associated selectivity is present for optional PLI but not for obligatory PLI. Mortality-associated selectivity in optional PLI vanishes when it is controlled for age.

2b. Rank-order stability of optional PLI declines with increasing time intervals. Rank-order stability of obligatory PLI shows no systematic changes with increasing time intervals.

2c. The estimated developmental trajectories for optional PLI across age differ when comparing cross-sectional and longitudinal findings. Less developmental change is observed with the longitudinal data. The estimated trajectories for obligatory PLI do not differ when comparing cross-sectional and longitudinal findings.

2d. Average PLI decreases when modeled across age (31 years) and remains unchanged when modeled across time-in-study (10 years).

2e. PLI selectivity increases when modeled across age and remains unchanged when modeled across time-in-study.

2f. Obligatory PLI remains unchanged when modeled across both age and time-in-study.

2g. Optional PLI decreases when modeled across age and decreases when modeled across time-in-study.

2h. Change in obligatory PLI impacts on change in optional PLI. Change in optional PLI has only a small impact or no impact on change in obligatory PLI.

3. The functional role of personal life investment for successful aging

3a. Optional PLI and average PLI are positively related, PLI selectivity is negatively related, and obligatory PLI is unrelated to functional health.

3b. Optional PLI and average PLI are positively related, PLI selectivity is negatively related, and obligatory PLI is unrelated to life satisfaction and aging satisfaction.

3c. Average PLI moderates the relationship between functional health and satisfaction: Initial levels of health and satisfaction demonstrate stronger positive associations at higher levels of average PLI. Change in health and change in satisfaction demonstrate stronger positive associations when average PLI is not reduced.

3d. PLI selectivity moderates the relationship between functional health and satisfaction: Initial levels of health and satisfaction demonstrate stronger positive associations at lower levels of PLI selectivity. Change in health and change in satisfaction demonstrate stronger positive associations when PLI selectivity is not increased.

3e. Optional PLI moderates the relationship between functional health and satisfaction: Initial levels of health and satisfaction demonstrate stronger positive associations at higher levels of optional PLI. Change in health and change in satisfaction demonstrate stronger positive associations when optional PLI is not reduced.

3f. Obligatory PLI does not moderate the relationship between functional health and satisfaction.

3g. Obligatory PLI moderates the relationship between optional PLI and satisfaction: Initial levels of optional PLI and satisfaction demonstrate stronger positive associations at higher levels of obligatory PLI. Change in optional PLI and change in satisfaction demonstrate stronger positive associations when obligatory PLI is not reduced.
In order to study the development of the four PLI facets, the relations between the development of obligatory PLI and optional PLI, and the role of PLI for successful aging, the longitudinal BASE sample (i.e., those persons who participated in at least two measurement occasions; \( N = 206 \)) is employed. In addition to the longitudinal PLI data, longitudinal data on functional health, life satisfaction, and aging satisfaction are considered. The different selection of persons and variables may lead to the questions of whether the validation results reported for the cross-sectional sample also hold true in the longitudinal sample and whether the results on the development and functionality of PLI from the longitudinal sample also hold true in the cross-sectional sample. Therefore, where appropriate, analyses are repeated with the longitudinal sample or, respectively, cross-sectional sample and included in the Appendix.
G METHODS

The Berlin Aging Study (BASE; for details see P. B. Baltes & Mayer, 1999; P. B. Baltes & Smith, 1997; Smith & Delius, 2003; Smith, Maas et al., 2002) is a multidisciplinary study on the lives of the old and oldest old (age 70 to over 100). BASE was established in 1989 to investigate late-life development from the joint and collaborative perspectives of psychiatry, psychology, sociology, and internal medicine. Survivors of the initial cross-sectional BASE sample were included in longitudinal follow-ups if they were willing and able to participate. Until now, BASE comprises five measurement occasions that were conducted between 1990 and 2000. The second occasion consisted of only a short intake interview that did not comprise the extensive self and personality measurement battery that was employed at the other occasions. Thus, PLI—along with most other self and personality constructs—was measured on four out of five occasions. All participants who took part in the third measurement occasion (second PLI assessment) were included in the longitudinal sample studied in this dissertation. Participation in the fourth and fifth occasion was not required to become part of the longitudinal sample.

1 Participants

The cross-sectional BASE sample was designed to be locally representative of the western districts of Berlin (BASE was initiated before the unification of Germany) and to over-sample the very old and the male population. It is a heterogeneous age-by-sex stratified sample of community-dwelling and institutionalized individuals that was randomly drawn from the city registration office (in Germany, every citizen registers with the city). The sample was divided into six age groups (70 – 74, 75 – 79, 80 – 84, 85 – 89, 90 – 94, and 95 – 103 years). Each age group comprised 43 females and 43 males, resulting in a sample of \(N = 516\) participants. Survivors of the 516 cross-sectional sample (T1 sample) have been recontacted on up to four occasions. As would be expected, the stratified age distribution at the first measurement occasion was not maintained in the longitudinal sample. A much larger proportion of participants aged over 90 at T1 dropped out of the study compared to participants in their seventies and eighties (Smith & Delius, 2003; Smith, Maas et al., 2002). Furthermore, no new participants were included in the study after the first measurement occasion. Thus, the number of participants in the youngest age groups is also considerably reduced at the last measurement occasion. The stratification by gender remained relatively stable during the third occasion but shifted toward a higher percentage of women during the fourth (55% women) and fifth (61% women) occasions.
Five BASE participants (all women) produced multivariate outliers on the PLI data and were excluded from this study (cf. G3). Demographic characteristics of the resulting reduced cross-sectional sample and longitudinal sample at T3 are summarized in Table 4. A description of the longitudinal T5 sample was also included to illustrate the demographic characteristics of persons who participated in all measurement occasions (for a detailed description of all longitudinal BASE samples see Smith & Delius, 2003). For each sample, demographic data at the respective measurement occasion are reported (i.e., T1 data for the T1 sample, T3 data for the T3 sample, and T5 data for the T5 sample). As men and women show important differences in demographic variables the information is also given separately for men and women.

The mean age of the three samples remained fairly constant (84 – 86 years), reflecting the higher dropout rates for older participants and simultaneously the aging of the remaining participants. However, the T3 and T5 samples included a narrower age range. Representative for these cohorts in Germany, only 7% of the T1 sample had more than 13 years of education. Men had somewhat higher levels of education than women. As years of education (in contrast to other demographic characteristics) did not change across time in study, it is evident that the participants in the longitudinal samples were more educated compared to the participants in the overall cross-sectional sample. In terms of income, equivalent income (cf. Mayer, Maas, & Wagner, 1999) in the T1 sample averaged 2,041 German Mark (DM; about $1,204). Average income was higher in the two longitudinal samples (T3: 2,331 DM, about $1,375; T5: 2,550 DM, about $1,505). This change in income, however, does not directly speak to sample selectivity but also reflects adjustment for inflation across time. The issue of sample selectivity will be discussed in more detail in a subsequent section (G4). Parallel to levels of education, women, on average, also had a lower income than men. At the first occasion, about 30% of the sample was married, 55% were widowed, and the remaining 15% were divorced or had never married. There was a large gender difference in marital status: Over 50% of the men were still married, whereas only about 8% of the women were married. In the longitudinal samples, again, processes of sample selectivity and change in marital status (mostly bereavement) overlap. The gender difference in marital status remained unchanged. At the time of study, about 87% of the T1 participants resided in their own homes (either alone or together with others) and 13% in institutions (e.g., nursing homes, homes for seniors, or hospitals). The percentage of institutionalized elders was somewhat lower at T3 (5%) and T5 (6%). Overall, the longitudinal samples appear to be a somewhat positive selection of the T1 participants. It is also important to note that the men in

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6 Four of the five outliers would have been part of the longitudinal sample and hence the T3 sample is reduced to 202 participants. At the same time, however, four participants did not complete the T3 intensive protocol but again joined the study for the T4 intensive protocol (and one participant also the T5 intensive protocol). Thus, the resulting longitudinal sample comprises 206 individuals, four of whom did not provide data on self and personality at T3.
BASE can be considered a resource-rich group compared to the women (as is typical for these cohorts): They have higher levels of education and income and are much more likely to receive social support from a spouse.

Table 4
Demographic Characteristics of Participants of the Cross-Sectional and Longitudinal BASE Samples

<table>
<thead>
<tr>
<th>Demographic characteristics</th>
<th>Cross-Sectional Sample (T1)</th>
<th>Longitudinal Sample (T3)</th>
<th>Longitudinal Sample (T5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (N = 511)</td>
<td>Men (n = 258)</td>
<td>Women (n = 253)</td>
</tr>
<tr>
<td><strong>Age (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70 – &lt; 80</td>
<td>33.5</td>
<td>33.3</td>
<td>33.6</td>
</tr>
<tr>
<td>80 – &lt; 90</td>
<td>33.3</td>
<td>33.3</td>
<td>33.2</td>
</tr>
<tr>
<td>90 – 100+</td>
<td>33.3</td>
<td>33.3</td>
<td>33.2</td>
</tr>
<tr>
<td><strong>M (in years)</strong></td>
<td>84.9</td>
<td>84.7</td>
<td>85.1</td>
</tr>
<tr>
<td><strong>SD (in years)</strong></td>
<td>8.7</td>
<td>8.4</td>
<td>8.9</td>
</tr>
<tr>
<td><strong>Years of education (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>28.6</td>
<td>17.1</td>
<td>40.3</td>
</tr>
<tr>
<td>10</td>
<td>27.0</td>
<td>32.6</td>
<td>21.3</td>
</tr>
<tr>
<td>11 – 13</td>
<td>37.0</td>
<td>38.0</td>
<td>36.0</td>
</tr>
<tr>
<td>&gt; 13</td>
<td>6.7</td>
<td>11.2</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Income (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1,000 DM</td>
<td>4.9</td>
<td>4.7</td>
<td>5.1</td>
</tr>
<tr>
<td>1,000 – 1,399 DM</td>
<td>19.2</td>
<td>18.2</td>
<td>20.2</td>
</tr>
<tr>
<td>1,400 – 1,799 DM</td>
<td>19.4</td>
<td>18.2</td>
<td>20.6</td>
</tr>
<tr>
<td>1,800 – 2,199 DM</td>
<td>20.7</td>
<td>15.1</td>
<td>26.5</td>
</tr>
<tr>
<td>&gt; 2,200 DM</td>
<td>35.8</td>
<td>43.8</td>
<td>27.7</td>
</tr>
<tr>
<td><strong>M (in DM)</strong></td>
<td>2,041</td>
<td>2,209</td>
<td>1,870</td>
</tr>
<tr>
<td><strong>SD (in DM)</strong></td>
<td>1,044</td>
<td>1,293</td>
<td>665</td>
</tr>
<tr>
<td><strong>Marital status (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>30.1</td>
<td>52.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Widowed</td>
<td>54.8</td>
<td>39.9</td>
<td>70.0</td>
</tr>
<tr>
<td>Divorced</td>
<td>7.2</td>
<td>4.3</td>
<td>10.3</td>
</tr>
<tr>
<td>Single</td>
<td>7.8</td>
<td>3.5</td>
<td>12.3</td>
</tr>
<tr>
<td><strong>Type of residence (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living alone</td>
<td>51.1</td>
<td>36.8</td>
<td>65.6</td>
</tr>
<tr>
<td>Living with others</td>
<td>35.6</td>
<td>53.5</td>
<td>17.4</td>
</tr>
<tr>
<td>Institutionalized</td>
<td>13.3</td>
<td>9.7</td>
<td>17.0</td>
</tr>
</tbody>
</table>

*5 data on income were not collected in BASE. Data for the T5 sample are based on observations at T4.
*4 data on marital status were not available in this study. The reported data are taken from Smith and Delius (2003).
N(total) = 82; n(men) = 32; n(women) = 50.
*Per capita monthly income weighted according to size of household. DM = Deutsche Mark.

2 Design and Procedure

Data collection at the first measurement occasion took place between 1990 and 1993. The participants were intensively studied during 14 sessions: 7 one multidisciplinary intake assessment, three sociology sessions, three psychology sessions, three psychiatry sessions, and four internal

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7 Where necessary, test sessions were split across more than one unit of assessment. That is, some participants took more than 14 sessions to complete the entire protocol.
medicine and geriatrics sessions. All sessions lasted about 90 minutes each and mostly were conducted at the participant’s place of residence (except for some medicine sessions). The sessions were usually separated by at least one week. The data employed in this study were collected by trained research assistants in face-to-face interviews during the intake assessment, one of the psychology sessions, and one of the psychiatry sessions. The constructs used in this study are listed in Figure 8 in the sequence in which they were originally assessed. At the second measurement occasion (1993 – 1994), 431 of the 516 participants were still alive, 84% of whom completed the single-session multidisciplinary intake assessment. At the third occasion (1995 – 1996), the number of sessions was reduced to the intake assessment, one session for each research unit, and one session on everyday competence. Sixty-six percent of the 313 survivors completed all six sessions. This reduced measurement protocol was repeated at the fourth measurement occasion (1997 – 1998), when 239 of the original 516 participants were still alive. Fifty-five percent of the surviving participants took part in all six sessions. The measurement protocol was further shortened to the intake assessment, two psychology sessions, and a dental examination at the fifth and last measurement occasion in 2000. At that time, 159 persons were still alive, 63% of whom completed all four sessions. Longitudinal data (T2 to T5) selected for this study were always collected during the intake assessment and one of the psychology sessions. As PLI data were not collected at T2 and data from the intake assessment at T5 were not provided for this study, the available information at the five occasions is somewhat unevenly distributed. Specifically, the only information available at T5 are the PLI data. The time interval between measurement occasions was about two years on average (except for the interval between T4 and T5, which was about three years). However, as can be seen in Figure 8, time intervals between occasions varied considerably between and within participants. Throughout all sessions, participants received a monetary compensation for taking part in BASE.
<table>
<thead>
<tr>
<th>Time 1 (T1)</th>
<th>1990 – 1993</th>
<th>(N = 516)</th>
<th>14 Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intake Assessment:</strong></td>
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<tr>
<td>- Life satisfaction</td>
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<td>- Functional health</td>
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<td>- Aging satisfaction</td>
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<td><strong>8th Session:</strong></td>
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<td>- Self-definition:</td>
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<td>Who am I?</td>
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<td>- Possible selves:</td>
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<td>Hopes and Fears</td>
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<tr>
<td>- Extraversion, neuroticism, openness</td>
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<td>- Personal life investment</td>
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<td>- Positive and negative affectivity</td>
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<td>- Daily activities:</td>
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<tr>
<td>Yesterday Interview</td>
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<tr>
<th>Time 2 (T2)</th>
<th>1993 – 1994</th>
<th>(N = 359)</th>
<th>1 Session</th>
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<tbody>
<tr>
<td><strong>Intake Assessment:</strong></td>
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<tr>
<td>- Life satisfaction</td>
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<td>- Aging satisfaction</td>
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<tr>
<td><strong>Distance (years):</strong></td>
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<tr>
<td>(M = 2.0)</td>
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<td>?1.0 – 4.1</td>
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<tr>
<th>Time 3 (T3)</th>
<th>1995 – 1996</th>
<th>(N = 206)</th>
<th>6 Sessions</th>
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<tr>
<td><strong>Distance (years):</strong></td>
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<tr>
<td>(M = 1.8)</td>
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<td>?0.8 – 2.5</td>
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<th>1997 – 1998</th>
<th>(N = 132)</th>
<th>6 Sessions</th>
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<td>- Functional health</td>
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<td>- Aging satisfaction</td>
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<tr>
<td><strong>Distance (years):</strong></td>
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<tr>
<td>(M = 1.8)</td>
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<td>?1.0 – 2.6</td>
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<th>Time 5 (T5)</th>
<th>2000</th>
<th>(N = 82)</th>
<th>4 Sessions</th>
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<tr>
<td><strong>Distance (years):</strong></td>
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<tr>
<td>(M = 3.4)</td>
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<td>?2.8 – 3.8</td>
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*Figure 8. Study design and selected variables.*
3 Measures

The majority of the selected constructs was measured on 5-point Likert scales, but there were also other scales and formats, for instance, for the health data. If not otherwise stated, scales were transformed to a new metric reflecting the individual’s position on the scale as a percent of the maximum possible (POMP) score, that is, the highest score that can theoretically be attained on this scale (irrespective of whether someone actually has attained it). The resulting scores can range between 0 and 100. POMP is a meaningful and highly communicative method of scoring (P. Cohen, Cohen, Aiken, & West, 1999) and may also ease calculations with SEM software. If one can theoretically determine minimum and maximum possible scores, POMP scores can be computed as

\[
POMP = \left( \frac{\text{observed score} - \text{minimum score}}{\text{maximum score} - \text{minimum score}} \right) \times 100. \tag{1}\]

Descriptive statistics of all study variables after transformation to this new metric are reported Appendix A1. An overview of the variables for which this metric was not considered as feasible and, hence, other transformations were employed is also given.

Checking for normality and dealing with outliers. As a first step in data analysis, all variable distributions were checked for normality and univariate outliers using SPSS EXAMINE. Departures from normality were identified as absolute ratios of skewness or kurtosis to their respective standard errors being smaller than two. As the sample size at T1 exceeded 500 participants, ratios above two were considered as acceptable for T1 data if absolute skewness did not exceed 0.5 and absolute kurtosis did not exceed 1.0 (Lienert & Raatz, 1994). Univariate outliers were identified as cases that are more than 1.5 times the interquartile range (difference between 75th and 25th percentile) smaller than the 25th percentile or larger than the 75th percentile (SPSS Inc., 1999). Where univariate outliers were detected, they were assigned the smallest or largest value that did not produce an outlier. After adjustment of univariate outliers, variables did not substantially depart from normality. A nonlinear transformation was therefore only applied to the activity data (see below). With the longitudinal data, identical adjustments were made on all occasions for the same variable to ensure comparability of scales across time. Appendix A1 contains detailed descriptions of variable distributions, the number of detected univariate outliers, and adjustments.

In addition to screening for univariate outliers, multivariate outliers on PLI were identified as cases with Mahalanobis distance at \( p < .001 \) (Tabachnick & Fidell, 1996). The ten PLI items were first screened together for each measurement occasion to detect participants with highly unusual patterns of PLI. Then, participants were grouped according to the number of measurement occasions they had completed (ranging from two to four) and the repeated assess-
ments of each of the four PLI facets were inspected together. This way, it was possible to identify people who showed highly unusual developmental trajectories. Screening for multivariate outliers was performed before and after adjustment of univariate outliers. In the end, five participants were identified as multivariate outliers on PLI (two based on unusual PLI patterns, three based on extreme trajectories). Inspection of those participants’ data confirmed the results of the analyses: All five participants had provided implausible or highly unusual ratings of PLI. The five participants were excluded from all further analyses.

*Personal Life Investment.* The Personal Life Investment Schedule (PLI Schedule; Staudinger & Fleeson, 1996; Staudinger et al., 1999) was developed for the Berlin Aging Study and hence was fit to the necessities of data collection in a sample of old and very old people. As part of a large measurement battery on self and personality the questionnaire also had to be very brief and was limited to ten life domains that are of high relevance during old age, but also during younger ages. Participants are not asked to generate idiosyncratic goals when they report on PLI. Rather, they judge their overall energy investment in different life domains that include goals on all levels of the personal goal hierarchy. This strategy makes the PLI Schedule optimally suited for longitudinal research on personal goals. The specific goals in different life domains may change over the years—in fact, one would hardly expect that low-level goals stay the same. But while one can expect to see some change in the specific personal goals that make up the goal hierarchy, one does not expect to see one of the ten goal domains vanish altogether.

PLI was assessed as the amount of energy and effort invested in terms of action and thought in ten life domains: health, cognitive fitness (cognition), hobbies and interests (leisure), friends and acquaintances (friends), sexuality, well-being of family members (family), occupation or occupation-like activities (work), independence, thinking about one’s life (life reflection), and one’s death and dying (death). Participants rated their PLI on 5-point Likert scales (1 = very much investment, 5 = no investment; item coding was reversed such that higher scores indicate more investment). An English translation of the original German instruction and questionnaire used in BASE is included in Appendix A2. Mean scores were computed to obtain the PLI facets of *average PLI* (mean of all ten PLI items), *obligatory PLI* (mean PLI in health, cognition, family, independence, life reflection, death), and *optional PLI* (mean PLI in leisure, friends, sexuality, work) for each measurement occasion. As a general rule, mean scores were computed for all participants with a maximum of one missing item for the respective scale. As most participants fulfilled this criterion, this procedure did not lead to a substantial loss of potentially relevant information: For the T1, T3, and T4 data, all participants matched the criterion; average PLI and obligatory PLI at T5 were not computed for one participant because of too many missing data. *PLI selectivity* was computed for each participant as the standard deviation across the ten PLI
ratings. High variability among the ten PLI ratings hints at a selective focus on some life domains. PLI selectivity was computed only for participants with no missing data on the PLI items at the respective occasion. Internal consistencies of PLI facets at the four measurement occasions were $\alpha_{T1} = .69$, $\alpha_{T3} = .64$, $\alpha_{T4} = .70$, and $\alpha_{T5} = .72$ for average PLI; $\alpha_{T1} = .67$, $\alpha_{T3} = .59$, $\alpha_{T4} = .65$, and $\alpha_{T5} = .60$ for obligatory PLI; and $\alpha_{T1} = .48$, $\alpha_{T3} = .46$, $\alpha_{T4} = .58$, and $\alpha_{T5} = .53$ for optional PLI. Retest stability of average PLI across 8 weeks was $r = .69$ in a sample of 40 older adults (Staudinger et al., 1992).

With longitudinal data, not only the internal consistencies of scales are of interest but also the question of whether the scales measure the same latent construct across all measurement occasions. Measurement invariance is a prerequisite for valid inference and interpretation in any study of change. It can be demonstrated by testing the factorial invariance of the proposed factor model, here, a two-factor model for PLI that represents the factors of obligatory PLI and optional PLI. Thereby, we have to differentiate between two levels of factorial invariance: configural invariance and metric invariance (cf. Horn, McArdle, & Mason, 1983; Schaie, Maitland, Willis, & Intrieri, 1998). Configural invariance means that all items marking the factors have their primary non-zero loading on the same factor across groups or occasions and also identical zero loadings on other factors. Metric invariance requires the additional demonstration of equality of the unstandardized factor loadings across groups or time. If metric factorial invariance can be demonstrated, one can be fairly sure that the meaning of the constructs does not change across time (e.g., Horn & McArdle, 1992; Horn et al., 1983; Meredith, 1964, 1993; Nesselroade, 1983).

Confirmatory factor analyses and tests for the factorial invariance of the two-factor model for PLI were conducted and are reported in Appendix A3. The results of these analyses demonstrate that a two-factor model is the best representation of the cross-sectional PLI data. The factor loadings of the PLI items further show metric invariance across different age groups and different measurement occasions.

However, before drawing conclusions on the reliability and factorial structure of PLI, one note of caution is at issue. Both the demonstration of internal consistency and the demonstration of factorial invariance rest on specific theoretical assumptions: Answers across the various items are conceptualized as effects of underlying latent variables. That is, participants are assumed to possess latent dispositions toward obligatory PLI and optional PLI and these dispositions influence responses to the ten PLI items. The PLI items are hence considered as effects indicators (Bollen & Lennox, 1991; MacCallum & Browne, 1993). However, this model does not match with the theoretical conceptualization of obligatory PLI and optional PLI. Obligatory PLI and optional PLI are not personal dispositions but rather indicators of the amount of effort that is currently invested in obligatory and optional life domains. Here, the PLI items should be con-
sidered as *causal indicators* (Bollen & Lennox, 1991; MacCallum & Browne, 1993), that is, high investment in leisure, friends, sexuality, and work is what causes high optional PLI rather than the other way round. Obligatory PLI and optional PLI are appropriately depicted as emergent phenomena, that is, they result from the interaction of the person and his or her contextual opportunities and demands. Each of the ten PLI items should be viewed as a “scale” of its own that measures investment in a specific life domain. Someone who invests much energy in the health domain does not necessarily also invest much energy in the family domain. Considered together, however, investment in health and family, together with investment in other obligatory life domains, tells us something about this person’s obligatory PLI. This implies that neither Cronbach’s alpha as a measure of internal consistency nor a confirmatory factor analysis are *theoretically* adequate for testing the reliability of the constructs obligatory PLI and optional PLI. It also leaves us with the problem that there is no widely known statistical test for the reliability or factorial invariance of a two-factor model with only causal indicators.8

Furthermore, the emergence of a two-factor structure of PLI may be specific to old age: If diminishing resources are associated with declining optional PLI and stable obligatory PLI, this would be reflected in the correlative structure of the ten PLI items. However, during young adulthood, a life phase when plenty of resources are available, the correlative pattern of PLI items may not suggest a two-factor structure reflecting obligatory PLI and optional PLI.

Thus, the reported results on internal consistencies of PLI facets and on the factorial invariance of the two-factor model for PLI show that there is some overlap in what is measured with the PLI items and that the correlative pattern of the PLI items does not change across time or age, which is a prerequisite for conducting longitudinal comparisons of the PLI facets. From a methodological standpoint, this is a highly relevant finding. However, from a theoretical standpoint, we should not interpret the results as speaking to whether the constructs of average PLI, obligatory PLI, and optional PLI were reliably measured. Specifically, an internal consistency of .48 for optional PLI at T1 indicates that there is some overlap between the four items that measure optional PLI but that the overlap is not particularly high. It does *not* mean that, therefore, optional PLI is not reliably measured and the results should be interpreted with caution. There is no “true” optional PLI of which investment in friends, leisure, sexuality, and work are merely some select indicators.

*Extraversion, neuroticism, openness.* Three of the Big Five were assessed in BASE. Items were selected from the NEO-FFI (Costa & McCrae, 1985; a German translation was published by

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8 The multiple-indicator-multiple-cause models (MIMIC models) discussed by Hauser and Goldberger (1971; see also Bollen, 1989; Gallo, Anthony, & Muthén, 1994) would allow to test for the invariance of associations between causal indicators and a latent construct. As those models, however, always require to simultaneously include effects indicators of the same latent construct this strategy is not applicable here.
Borkenau & Ostendorf, 1993) and adapted for use with very old people. Most importantly, items including double-negatives were reformulated to aid comprehension. Six items were selected for each dimension: extraversion (E) with the facets assertiveness, gregariousness, positive emotions, and activity; neuroticism (N) with the facets anxiety, hostility, depression, and vulnerability; openness to experience (O) with the facets fantasy, ideas, feelings, aesthetics, and actions. All items were responded to on 5-point Likert scales. Considering the shortness of the scales and the heterogeneity of items (the different facets were often measured by just one item), internal consistencies (Cronbach’s alpha) are satisfactory (E: $\alpha = .64$; N: $\alpha = .75$; O: $\alpha = .42$). In a subsample of BASE participants ($N = 104$) retest reliabilities across eight weeks were estimated for E, N, and O. All three dimensions showed considerable temporal stability (E: $r = .87$; N: $r = .87$; O: $r = .77$; Freund & Smith, 1999b).

Positive and negative affect were measured with a translated version of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). Participants rated on 5-point scales how frequently they had experienced ten positive (e.g., excited, proud, determined) and ten negative (e.g., anxious, distressed, nervous) emotions during the past year. Positive and negative affectivity were computed as the unweighted item mean. Internal consistencies for positive affectivity ($\alpha = .78$) and negative affectivity ($\alpha = .81$) were satisfactory. Temporal stability of positive and negative affectivity was also estimated in the BASE subsample (positive affectivity: $r = .76$; negative affectivity: $r = .88$; Freund & Smith, 1999b).

Internal control beliefs. Generalized perceived control was assessed with a 14-item self-report measure developed in BASE after Levenson (1981; see Kunzmann et al., 2002; Smith & Baltes, 1999). For this study, the dimension of perceived personal control over desirable outcomes was chosen, which was measured as the mean across three items: “It’s up to me to arrange for all the good things in my life.” “I can make sure that good things come my way.” “When I get what I want, it is usually because I have worked hard for it.” Participants indicated on 5-point scales how much the items applied to them. Cronbach’s alpha for internal control beliefs was $\alpha = .64$.

Self-definitions. The self-definition was assessed with an open-ended, free-response measure (Bugental & Zelen, 1950; see also Freund, 1995; Freund & Smith, 1999a). Each participant provided ten answers to the question “Who am I?” These answers were given verbally and were simultaneously tape-recorded and written down by a research assistant. Responses were coded as reflecting one of 24 content categories with a coding system that had been developed specifically for assessing the self-definition of old and very old people (Freund, 1995; see also Freund & Smith, 1999a, b). Agreement between two independent coders for these categories was satis-
factory (Kappa was $\kappa = .85$). The 24 categories were subsequently reduced to 20 categories by collapsing four pairs of highly similar categories. For this study, the number of different self-defining domains (up to 10) was of interest as a possible indicator of the selectivity of self-defining investments. Furthermore, the 20 content categories were matched to the ten PLI domains. Six content categories (sociodemographic variables, personality traits, emotions/mood, body image, life events, interpersonal style) bore no resemblance with the PLI domains and were not considered for the validation of PLI. The remaining 14 categories were matched to the PLI domains. Table 5 shows the resulting assignments.

<table>
<thead>
<tr>
<th>PLI Domain</th>
<th>Content Category Self-Definition/ Possible Selves</th>
<th>Activity Category Yesterday Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health</td>
<td>Health</td>
<td>Sleeping, doing nothing, going to bed, (medical) treatment, health-related self-treatment, taking a walk, sports, excursions</td>
</tr>
<tr>
<td>Cognitive fitness</td>
<td>Intellectual functioning</td>
<td>TV/video, radio/tapes/records, reading, writing, talking on the phone, playing, cultural activities</td>
</tr>
<tr>
<td>Family</td>
<td>Family</td>
<td>No activity category selected</td>
</tr>
<tr>
<td>Independence</td>
<td>Everyday competence</td>
<td>Eating/drinking, personal care, other self-care activities, arising, passive transportation, active and other transportation, light household chores, shopping, heavy household chores, gardening, other chores, needlework/handicraft, dealing with the post office, banking, dealing with authorities/institutions, dealing with other official institutions, planning, helping other persons, cultural activities</td>
</tr>
<tr>
<td>Life reflection</td>
<td>Life balance/life review</td>
<td>Religious activities</td>
</tr>
<tr>
<td>Religious or (socio-)political beliefs/ attitudes</td>
<td>Life knowledge</td>
<td></td>
</tr>
<tr>
<td>Death and dying</td>
<td>Death and dying</td>
<td>Religious activities</td>
</tr>
<tr>
<td></td>
<td>Religious or (socio-)political beliefs/ attitudes</td>
<td></td>
</tr>
<tr>
<td>Leisure</td>
<td>Interests/hobbies at home</td>
<td>Gardening, sports, excursions, education, creative activities, needlework/handicraft, playing, cultural activities, other leisure activities</td>
</tr>
<tr>
<td></td>
<td>Interests/hobbies outdoors</td>
<td></td>
</tr>
<tr>
<td>Friends</td>
<td>Social relations (not family)</td>
<td>No activity category selected</td>
</tr>
<tr>
<td>Sexuality</td>
<td>No relevant content category</td>
<td>No relevant activity category</td>
</tr>
<tr>
<td>Work</td>
<td>Profession/profession-like activities</td>
<td>Regular paid work, other work, political activities/community service</td>
</tr>
</tbody>
</table>
Participants sometimes named more than one self-definition per content category. Based on the number of self-definitions across all PLI-relevant content categories, two variables were computed. Self-definitions across all content categories classified as obligatory (upper part of Table 5) were summed up to arrive at the number of self-definitions in obligatory life domains. The number of self-definitions in optional life domains was computed as the number of self-definitions in content categories considered as optional (lower part of Table 5). As some self-definitions were not classified as either obligatory or optional, the number of self-definitions in obligatory domains and the number of self-definitions in optional domains do not necessarily add up to 10 (the number of self-definitions each participant was asked to provide).

Possible selves. Hoped-for and feared possible selves were assessed with an open-ended task that was adapted for use in BASE from measurements of possible selves described previously (e.g., Cross & Markus, 1991; Hooker, 1992). Participants were asked to identify at least two hopes and two fears about their future. Hoped-for selves were introduced as personal wishes and hopes, who one would like to become, the sort of person one would like to be, what experiences and feelings one would like to have. Feared selves were described as images of oneself that one fears or dreads, what sort of person one would not like to become, what experiences and feelings one would not like to have. The spontaneous responses were again tape-recorded and written down by a research assistant. Participants’ hopes and fears were categorized with the same coding system that had been developed for the self-definitions (Freund, 1995; Freund & Smith, 1999a). The total numbers of hopes and fears were determined and hopes and fears were again coded into the 24 content categories. Transcripts of hopes and fears were coded separately. Interrater agreement was satisfactory (κ = .82). Parallel to the procedure for self-definitions, data were aggregated to obtain the following variables: Total number of hopes and total number of fears, number of hopes and number of fears in content categories classified as obligatory (Table 5), and number of hopes and number of fears in content categories classified as optional (Table 5). Please note that number of hopes in obligatory categories and number of hopes in optional categories do not add up to the total number of hopes, as some content categories were not classified as either obligatory or optional. The same applies for number of fears.

Daily activities. Everyday activities were assessed with the Yesterday Interview (Moss & Lawton, 1982). The Yesterday Interview attempts at a minute-to-minute reconstruction of the sequence and context of activities during the previous day as remembered by the interviewee. The type and duration (in minutes) of activities from awaking on the day preceding the interview until falling asleep and also the presence of social partners were reported. Depending on the day of the interview, “yesterday” referred to different days of the week for different participants. No
test sessions were conducted on Saturday and Sunday. Therefore, “yesterday” was some day between Sunday and Thursday. All activities were subsequently coded into one of 44 activity categories (M. M. Baltes et al., 1999; Horgas et al., 1998; Klumb & Baltes, 1999a). Interrater reliabilities for these codings yielded Kappa coefficients above .80.

As with the self-definition and possible selves, the activity categories were matched to the PLI domains. In contrast to the content categories for current and possible selves, however, the correspondence between PLI domains and activity codes is less evident. For that reason, empirical results on the correspondence between PLI domains and activity codes were employed. In her study, Hornig (2003) developed a coding system that allowed to code various activities that were reported in a diary study with a subsample (N = 75) of the BASE T3 participants (Klumb, 2001; Klumb & Baltes, 1999b) into categories reflecting nine PLI domains (excluding sexuality). To account for the multifinality of actions, the activities were coded into one primary PLI category and also received codes for all others PLI domains that may be reflected. Agreement between two independent coders was satisfactory (κ = .78). The activities reported in the diaries had previously also been coded into the same 44 activity categories that were employed with the Yesterday Interview in BASE (median κ = .76). Thus, the correspondence between PLI domain categories and activity categories was determined with empirical data. Appendix A4 summarizes the resulting frequencies and types of different activities within each PLI domain. Only the first and most important PLI domain category was considered in the comparison. Activity categories were considered as indicative of a PLI domain if the majority of activities in this category fell into the respective PLI domain. If activity codes were about equally distributed among several PLI domains, the activity was considered as representative of each domain. The final assignment of activity categories to PLI domains is included in Table 5. With two PLI domains (family and friends), the described procedure did not lead to satisfactory results. Here, the problem is that very few activity categories clearly pertain to the domains of family or friends (see Appendix A4) but many activity categories may be relevant to these domains. Rather than considering specific activities it may thus be preferable to consider the time a person spends together with family members or friends. These data are available in BASE but their consideration would lead to new problems. Specifically, it would be problematic to integrate data on the amount of time spent with family members or friends with the other activity data to arrive at two variables reflecting the percentages of obligatory and optional activity. An integration would mean to consider many activities twice. For that reason, no activities were identified as indicative of investment in the domains of family and friends.

Three variables were computed from the T1 Yesterday Interview data for this study. The duration of total activity (in minutes) was computed as the time between getting up and falling
asleep. The waking day of BASE participants lasted between 10.0 and 22.0 hours (M = 16.1 hours). This variable was not transformed to POMP scores. Time already is a metric that is highly communicative and meaningful. POMP scores were computed for the remaining two variables. The percentages of time spent in obligatory and optional activity categories were determined for each individual. Based on the individual’s duration of total activity, those percentages were computed as

\[
POMP \text{ activity} = \left( \frac{M_{\text{minutes spent in activity category}}}{M_{\text{minutes total activity}}} \right) \times 100. \tag{2}\]

As the resulting scales of proportions tend to be bunched up at their extremes relative to their center, the arcsine transformation was subsequently applied to stretch out the tails and achieve a unit of measurement that is more nearly linearly related to other variables (J. Cohen, Cohen, West, & Aiken, 2003). Following that, the data were again transformed to a POMP scale to enhance interpretability—this time via a linear transformation that did not alter the new distributional properties (cf. P. Cohen et al., 1999). Please note that the POMP scores indicating the percentage of obligatory activities and the percentage of optional activities do not add up to 100. This is due to the fact that not all activity categories were classified as either obligatory or optional and hence some activities only contributed to the duration of total activity but not to the duration of obligatory or optional activity. Furthermore, as evident in Table 5, a few activities were classified as both obligatory and optional (e.g., gardening or sports) and included in both the percentage of obligatory activity and the percentage of optional activity.

Life satisfaction and aging satisfaction. Life satisfaction was assessed with a single item at each of the four measurement occasions included in this study: “How satisfied are you with your life at present?” Aging satisfaction was measured with five items from the Philadelphia Geriatric Center Morale Scale (PGCMS; Lawton, 1975; Liang & Bollen, 1983; McCulloch, 1991). Item content was identical from T1 to T4. Although the PGCMS was often reported in terms of an overall score, three factors were identified in BASE: nonagitation, aging satisfaction, and life satisfaction (Smith et al., 1999). Sample items for aging satisfaction include “Things keep getting worse as I get older.” (reverse coded) or “As I get older, things are better than I thought they would be.” Responses were again given on a 5-point scale. Internal consistencies for aging satisfaction were satisfactory at all measurement occasions (\(\alpha_{T1} = .74; \alpha_{T2} = .71; \alpha_{T3} = .71; \alpha_{T4} = .62\)). Moreover, metric factorial invariance for aging satisfaction between T1 and T4 has been demonstrated (Kotter, 2004).

The nonagitation scale was not employed in this study because it has much conceptual overlap with negative affectivity. The single-item indicator of life satisfaction was preferred to the life satisfaction scale as it is identical to commonly used single-item indicators and, thus, allows
for comparisons with other studies. Moreover, the life satisfaction scale contains some items that are not usually considered when measuring life satisfaction (e.g., “I have a lot to be sad about.” “I sometimes feel that life isn’t worth living.”). As life satisfaction is defined as a primarily cognitive evaluation of the quality of one’s experiences (e.g., DeNeve & Cooper, 1998; Diener & Suh, 1998; Lucas et al., 1996), it seemed important not to mix affective and cognitive appraisals.

**Functional health.** Only variables that were measured at four measurement occasions (T1 – T4) were considered for the creation of a functional health indicator, that is, only variables that were assessed during the multidisciplinary intake assessment. Everyday competence was measured as the ability to independently perform five basic Activities of Daily Living (ADL; Katz Index; Katz, Downs, Cash, & Grotz, 1970; see Steinhagen-Thiessen & Borchelt, 1999): getting up from a chair or bed, dressing, toileting, bathing or showering, and eating. Visual acuity was assessed using standard optometric procedures (Borchelt, Gilberg, Horgas, & Geiselmann, 1999; Marsiske et al., 1999; Steinhagen-Thiessen & Borchelt, 1999). Maximum distance visual acuity without glasses was measured binocularly and scored in Snellen decimal units. Auditory acuity was assessed with a Bosch ST-20-1 pure-tone audiometer, using headphones (Borchelt et al., 1999; Marsiske et al., 1999; Steinhagen-Thiessen & Borchelt, 1999). An index of speech-range auditory acuity was computed as the average threshold (in dB) at 1.0 and 2.0 kHz for both ears. Grip strength was assessed with standardized dynamometry (Steinhagen-Thiessen & Borchelt, 1993, 1999) as maximum grip strength (in kp) of the stronger hand across three measurements. Participants also reported on their subjective maximum walking distance that they could walk without pain and without interruption (ranging from unable to walk to more than 5 kilometers; Steinhagen-Thiessen & Borchelt, 1999). All functional health variables at T1 were transformed to a t-score metric to arrive at a comparable metric that allows averaging of the different functional health indicators. The POMP scale was not considered for health measures as there is, for instance, no theoretical maximum for grip strength. Measurements at T2, T3, and T4 were transformed to t-scores with reference to the T1 means and standard deviations of the entire cross-sectional sample (i.e., identical transformations were performed across all occasions). A unit-weighted composite of ADL, visual acuity, auditory acuity, grip strength, and mobility was computed as an indicator of functional health (in t-score units). Higher scores indicate better functional health. Cronbach’s alphas for the health indicator at the four measurement occasions were $\alpha_{T1} = .69$, $\alpha_{T2} = .60$, $\alpha_{T3} = .66$, and $\alpha_{T4} = .69$. Please note that the argument made for the PLI facets also applies here: As the five measurements of functional health are appropriately considered as causal indicators of functional health, internal consistencies should not be mistaken
as indicative of the reliability of the health indicator. Rather, they tell us something about the similarity of the different health measures.

4 Sample Selectivity

From the beginning, problems of sampling bias and sample selectivity have received special attention in BASE (P. B. Baltes & Smith, 1997; Lindenberger et al., 1999). The study of sample selectivity is especially important with populations of very old adults. Aging itself is a selection process in that not all people live to the same age. The resulting selectivity effects are referred to as *mortality-associated selectivity*. This kind of selectivity is a normal population process and does not threaten the generalizability of results. As with any other study, there are additional selectivity effects due to the fact that not all persons asked to take part in a study are willing and able to do so. These forms of sample selectivity are referred to as *experimental selectivity*. Experimental selectivity represents a sampling bias and hence may limit the generalizability of findings.

The random sampling procedure used in BASE is a highly efficient way of minimizing sampling bias. Still, more than seventy percent of the old and very old persons initially contacted did not complete the entire 14 sessions at T1 (P. B. Baltes & Smith, 1997; Lindenberger et al., 1999). The design of BASE, however, allowed for detailed estimations of selectivity effects through working with information from the city register and with various participation levels. In previous selectivity analyses, the cross-sectional BASE sample was compared to the entire sample of West-Berlin elders randomly selected from the city register, people who agreed to an initial contact and volunteered some basic information in a short initial assessment, and people who completed the multidisciplinary intake assessment but then dropped out of BASE (P. B. Baltes & Smith, 1997; Lindenberger et al., 1999). These analyses revealed that one-year mortality was reduced in the 516 cross-sectional BASE sample compared to the random sample drawn from the city registry. Furthermore, persons with better intellectual functioning, better vision and hearing, higher competence in ADL, fewer illnesses, higher socioeconomic status, and higher aging satisfaction were more likely to complete the entire 14-session data protocol. Nevertheless, all observed selectivity effects were small, that is, they never exceeded half a standard deviation. No indications of selectivity were found for variances or covariances. In sum, the cross-sectional BASE sample evinced positive selectivity when compared on 25 variables with samples at lower participation levels. However, all selectivity effects were small and pertained to levels of functioning but not to observed interindividual variability and covariation between variables (P. B. Baltes & Smith, 1997; Lindenberger et al., 1999). The T1 sample can thus be considered as fairly representative of the West-Berlin aged population.
With the availability of the first longitudinal BASE data, more detailed comparisons and separate estimations of mortality-associated selectivity and experimental selectivity became possible (Lindenberger et al., 2002; see also Singer, Verhaeghen et al., 2003; Smith & Delius, 2003). With respect to differences in means, the magnitude of mortality-associated selectivity (MAS) and experimental selectivity (ES) can be estimated as

\[
\text{MAS} = \frac{M_{\text{longitudinal survivors at T1}} - M_{\text{T1 sample}}}{SD_{\text{T1 sample}}} \\
\text{ES} = \frac{M_{\text{longitudinal sample at T1}} - M_{\text{longitudinal survivors at T1}}}{SD_{\text{T1 sample}}},
\]

where the longitudinal survivors represent the subsample of the T1 sample that was still alive during the measurement occasion of interest and the longitudinal sample is the subsample of the longitudinal survivors that actually participated in the measurement occasion. The resulting total selectivity equals MAS + ES (Lindenberger et al., 2002).

When comparing the T3 longitudinal sample with the T1 cross-sectional sample, evidence for nonrandom sample attrition was found (Lindenberger et al., 2002). Similar to previous findings on sample selectivity in longitudinal studies (e.g., P. B. Baltes, Schaie, & Nardi, 1971; McArdle, Hamagami, Elias, & Robbins, 1991), participants in the longitudinal study were younger, more educated, less often institutionalized or demented, in better physical and functional health, higher on intelligence measures, and had bigger social networks. Thereby, age, intelligence, and indicators of functional health were the variables with medium-sized effects. In contrast, two central variables of this study, life satisfaction and aging satisfaction, demonstrated only small positive selectivity effects. The larger part of the observed selectivity effects was associated with mortality; selective sampling of the survivors played only a minor role. Specifically, the average magnitude of experimental selectivity across 48 variables was 0.10 standard deviation units, which does not qualify for even a small effect (Lindenberger et al., 2002). When variables were regressed on age in order to differentiate between age-linked and age-orthogonal components of mortality-associated selectivity, mortality-associated selectivity effects were considerably reduced. That is, a significant portion of mortality-associated selectivity was collinear with chronological age.

Findings regarding variances and covariances in the T3 sample suggested that the longitudinal sample was less variable than the T1 sample on several indicators. Variability decrements tended to be higher in variables with large selectivity effects regarding means, for instance, age and functional health indicators. Those variance restrictions furthermore affected variable intercorrelations. For instance, correlations between intelligence and sensory functioning were attenuated by selectivity in the T3 sample (Lindenberger et al., 2002).

Overall, results regarding mean scores obtained with the T3 longitudinal sample can be fairly well generalized to the T1 sample, as experimental selectivity is low on average. However,
experimental selectivity effects for age showed small effects, suggesting that age relations observed in the T3 sample may be less pronounced than they actually are in the aging population. Moreover, the reduced variability in the T3 sample may reduce the strength of observable correlations, especially with variables that are strongly related to chronological age (Lindenberger et al., 2002). Two main concerns when analyzing the longitudinal BASE data are thus the underestimation of age-related changes and the underestimation of variable intercorrelations (especially where functional health is involved). Self and personality variables should be less problematic in this regard as they showed only small selectivity effects and smaller correlations with age compared to such variables as intellectual functioning or health.

Selectivity analyses comparing the T4 sample with the T1 sample showed that the T4 participants are a still more positive selection than the T3 participants (Singer, Verhaeghen et al., 2003; Smith & Delius, 2003). Here, total selectivity for intelligence ($0.74 SD$ units) and sensory functioning ($0.69 SD$ units) amounted to medium to large effects. Selectivity effects for socioeconomic status and personality variables (extraversion, neuroticism, openness) were still small. Aging satisfaction also evinced only small selectivity effects (Kotter, 2004). Both mortality-associated and experimental selectivity further were not equally distributed across age groups: Selectivity effects were larger for older participants (Singer, Verhaeghen et al., 2003).

Up to now, personal life investment data have not been included in the various selectivity analyses. Thus, mortality-associated selectivity and experimental selectivity will be estimated for means and variances/covariances of the PLI facets in this study (cf. H2). These analyses will be conducted for the entire longitudinal T3 and T5 samples and also separately for participants in their seventies, eighties, and nineties.

5 Statistical Models

The direct identification of person-specific trajectories has been considered as the foundation of any longitudinal analysis (P. B. Baltes & Nesselroade, 1979; cf. D4). In addition to describing the average change in a sample, the description of individual differences in trajectories is of paramount importance. Today, a variety of analytic approaches is available that can accomplish the simultaneous modeling of intraindividual change and interindividual similarities and differences in intraindividual change, even in the presence of incomplete data and with varied timing and spacing of observations (for introductions and comparisons of approaches see, e.g., Collins & Sayer, 2001; T. D. Little, Schnabel, & Baumert, 2000; Raudenbush, 2001). These approaches are variously labeled hierarchical models (Raudenbush & Bryk, 2002), multilevel models (Goldstein, 1999), latent growth models (McArdle & Anderson, 1990; McArdle & Bell,
latent difference score models (McArdle, 2001; McArdle & Hamagami, 2001), and so forth. In this study, latent difference score models (LDS models) are employed, which can be considered as an extension of latent growth models. Although LDS models and latent growth models are similar in many respects, LDS models have the advantage of including parameters that directly represent change in the true scores of a variable (cf. McArdle, 2001; McArdle & Hamagami, 2001; McArdle & Nesselroade, 2003). As these models are not yet commonly known and applied, the following sections describe LDS models in some more detail.

A brief description of the latent difference score (LDS) models relevant to this study can be organized around Figures 9, 10, and 11 (for more detailed descriptions of latent growth and latent difference score models see Hamagami, McArdle, & Cohen, 2000; McArdle, 2001; McArdle & Anderson, 1990; McArdle & Bell, 2000; McArdle & Hamagami, 1991, 2001; McArdle & Nesselroade, 2003). Figure 9 depicts possible LDS models for the longitudinal development of one PLI facet across time-in-study. Figure 10 depicts a bivariate LDS model that can be employed to test cross-lagged longitudinal relations between changes in obligatory PLI and changes in optional PLI. Figure 11 shows a bivariate LDS model that can be considered when longitudinal follow-ups have been conducted less frequently than would be required to represent the dynamic of the process of interest (as is the case in this study). Here, contemporaneous influences of change in one variable on change in the other variable are considered to determine the direction of causation.

Starting at the top of Figure 9, we first find the factors L (for level), S (for slope), and QS (for quadratic slope). Each person’s longitudinal trajectory can be described with the parameters of the status of that individual i at the first occasion (the initial level Li) and some change (a slope Si). Depending on the assumed change function, one slope factor may suffice (as with linear change) or one may need additional slope factors (such as QS, which is employed here to model quadratic change). Based on the estimated parameters for each individual i, several parameters are computed that describe the entire sample: The estimated means (μL, μS, μQS) and variances (σL^2, σS^2, σQS^2) for each factor inform about the average initial level, the average change, and also the amount of interindividual variability in levels and changes. The level and slope factors can also be correlated (σL,S, σL,QS, σS,QS). Figure 9 further illustrates how the model can account for different timing of observations and incomplete data. However, some background information is required in order to describe that part of the model.

Dealing with varying time intervals and incomplete data. An easy way to account for different timing and spacing of measurement occasions is to identify a set of possible time intervals or ages at which each participant could have been measured, that is, in theory, we could have collected
data during each of the ten years involved in BASE or we could have made annual assessments between 70 and 101 years for each participant. Both time-of-measurement and age-at-measurement are employed as metrics for the various LDS models in this study. This leads to 10 possible time intervals for time-in-study and 32 possible measurement ages. As there is a maximum of four PLI assessments, data become quite sparse at some years or ages when they are stretched out across one-year intervals for 10 years in study or an age range of more than 30 years. For this reason, data were grouped into two-year intervals. The T1 measurement occasion was coded as 0 for all participants. Depending on the individual time intervals between T1 and the remaining measurement occasions, each participant received values between 1 and 5 on a new time scale: Intervals of 1 and 2 years were coded as 1, 3 and 4 years as 2, 5 and 6 years as 3, 7 and 8 years as 4, and 9- and 10-year intervals received the code 5. Similarly, chronological age (in years) was expressed in 2-year intervals as 0 = 70 – 71, 1 = 72 – 73, 2 = 74 – 75, 3 = 76 – 77, 4 = 78 – 79, 5 = 80 – 81, 6 = 82 – 83, 7 = 84 – 85, 8 = 86 – 87, 9 = 88 – 89, 10 = 90 – 91, 11 = 92 – 93, 12 = 94 – 95, 13 = 96 – 97, 14 = 98 – 99, 15 = 100 – 101, 16 = 102 – 103, and 17 = 104 – 105. As only one participant in the longitudinal sample lived to the age of 102 – 103 and subsequently 104 – 105, these ages were not included in the LDS models across age, that is, the modeled age range is 70 – 101 years.

It is obvious that these new metrics lead to a substantial amount of incomplete data. At most, a participant provides four PLI measurements and two or, respectively, 12 missing measurements. In addition, sample attrition due to mortality and experimental mortality contributes a second kind of incomplete data, namely those that result from being unable to observe each participant at four measurement occasions. However, present SEM software can handle this problem. Building on the assumption that the data are at least missing at random (MAR), programs like Amos (Arbuckle & Wothke, 1999), Mplus (L. K. Muthén & Muthén, 1998), or Mx (Neale, Boker, Xie, & Maes, 1999) allow to fit structural equation models with incomplete data. MAR means that missingness is independent only of the missing values but can be linked to the observed values of other variables in the data set (Rubin, 1976). This assumption holds for the

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9 Although this reduction of time points is beneficial for the analyses it brings one drawback with it. As the minimal time intervals between T2 and T3 or T3 and T4 were less than one year for some participants, reduction to 2-year intervals led to some participants receiving the same new code for two subsequent measurement occasions. For example, one participant had a distance of 5 years between T1 and T3 and a distance of 6 years between T1 and T4. This person received the new code of 3 for the T3 and for the T4 occasion. Thus, it was not possible to distinguish data from these two occasions with the new time scale. In order to ensure that every observation for the same individual receives a different code, some slight adjustments were made for the 45 participants who had initially received the same code for two observations. As for these participants the exact time interval typically lay very close to the cutoff values between two two-year categories, time intervals were slightly enhanced or reduced in order to move them to the preceding or subsequent category. For our exemplary participant the exact distance between T1 and T3 was 5.19 years and the distance between T1 and T4 was 6.28 years. Here, the T1-T4 interval was enhanced to 6.50 years and thus moved to the next category spanning 7- and 8-year intervals. Overall, the differences between the original and new time intervals were small, ranging from 0.01 to 0.40 years (M = 0.12 years).

10 Apart from the age category at T1, age categories were determined based on the new time intervals.

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BASE data, where missingness is, for instance, related to age, health status, or intellectual functioning. Basically, the missing data method treats each participant as a separate group and assumes factorial invariance across all these groups or participants, that is, assumes that we can describe all participants with the same model. All available raw data are utilized to compute full information maximum likelihood parameter estimates, without either imputing or dropping data when incomplete. The basic algorithm consists of fitting each participant’s vector of raw data to the overall group estimated covariance matrix (e.g., Arbuckle, 1996; McArdle, 1994; L. K. Muthén & Muthén, 1998; Neale et al., 1999). Individual contributions to the overall misfit are computed by applying the usual fitting function to the individual data vectors and their respective portion of the estimated covariance matrix. The analysis of incomplete raw data furthermore requires the consideration of means in addition to covariances, that is, mean and covariance matrices are estimated as the default.

The standard output from missing data models differs from models with complete data. The completely saturated model, which is necessary in order to compute the fit $\chi^2$ and derived statistics such as RMSEA, is not fitted as a default. Likelihood-ratio $\chi^2$ testing of a series of nested models can, however, still be performed on the basis of the reported log-likelihood values of the nested models. The difference between twice the negative log-likelihood (-2LL) values of two nested models is $\chi^2$ distributed with degrees of freedom equal to the difference between the number of estimated parameters. Mplus, like Amos, also allows to estimate the saturated model and gives the associated fit indices. But especially with large amounts of incomplete data, estimation of the saturated model can be time-consuming, lead to computational difficulties, or become entirely impossible (L. K. Muthén & Muthén, 1998). As the main interest of the present analyses lies in the comparison of alternative models and not so much in the absolute model fit, the saturated model is not estimated. Model comparisons are based on the log-likelihood of nested models, the Akaike Information Criterion (AIC), and the Bayesian Information Criterion (BIC).

If we now return to Figure 9, we find the “observed” PLI data ordered across time-in-study (in 2-year intervals) denoted as PLI[0] to PLI[5]. As is the standard, squares denote manifest variables and circles denote latent variables. PLI[0], that is, PLI at T1, has been observed for every participant. As PLI was not measured at T2, no participant was observed 1 or 2 years after T1. Thus, PLI[1] is a latent variable for everyone. The combined circles and squares illustrate that PLI[2] to PLI[5] were observed for some participants but latent for other participants. Each “observed” PLI score is now decomposed into the sum of a latent true score $\text{pli}[t]$ plus some kind of independent error or unique score $e[t]$. These error scores are assumed to have a mean of zero and a nonzero variance ($\sigma^2_e$), which is constrained equal across all time points.
Beginning at the second observation, latent difference scores $\Delta \text{pli}[t]$ represent the rate of change in PLI across one unit of time (here, two years). PLI at time $[t]$ is the sum of PLI at time $[t-1]$ plus the change in PLI at time $[t]$. The changes in PLI as a function of changes in time can be related to two slopes ($\alpha[t] \times S; \lambda[t] \times QS$) and can be proportional to the previous state ($\beta \times \text{pli}[t-1]$). The most complex model that can be estimated uses three additive components, that is, it is a triple change score (TCS) model. Here, pli is assumed to show quadratic change across time (modeled with a linear slope and a quadratic slope). Simultaneously, change in pli depends on pli at the previous time point, as reflected by the autopropotional parameter $\beta$, which is constrained equal across all time points. In most cases, however, one does not need such a complex LDS model to arrive at an adequate representation of the data. Simpler models can be computed by constraining or omitting parameters. For instance, one obtains a constant change score (CCS) model if $\alpha$ is constrained to be equal across all time points and the quadratic slope factor QS and the autopropotional parameter $\beta$ are left out (see the lower part of Figure 9 for various models that can be specified). Here, a latent pli score for individual $i$ at time $[t]$ can be computed as this individual’s latent pli score at time $[t-1]$ plus a constant amount of change in pli, $\alpha \times S_i$.

A common strategy (e.g., Ghisletta & McArdle, 2001) to determine the best-fitting change score model is to start with a sensible baseline model and then step by step increase the complexity of the estimated model. If a more complex model does not improve the model fit, the less complex model can be viewed as an adequate representation of the data. In this study, a model representing no systematic change across time and interindividual variability in initial levels (NCS model) is used as a baseline model to which slopes and autopropotional parameters are added subsequently. With linear and quadratic change score models for PLI, values for $\alpha[t]$ and $\lambda[t]$ are always chosen such that they add up to 1 across time intervals spanning 10 years (i.e., $\alpha[1] = 0.20, \lambda[1] = 0.04, \lambda[2] = 0.12, \lambda[3] = 0.20, \lambda[4] = 0.28, \lambda[5] = 0.36$). The means for S and QS thus reflect the average linear and quadratic change in PLI across nine to ten years in study.

LDS models across chronological age are basically identical to the model depicted in Figure 9. In essence, there are two differences: (a) there are more PLI occasions, namely 16 instead of 6, and (b) all “observed” PLI scores need to be drawn as combined circles and squares. The interpretation of means and variances of $L$, $S$, and $QS$ also changes. When modeling across age, parameters are specified such that $\mu_L$ gives the mean PLI at 70 – 71 years and $\mu_S$ and $\mu_QS$ represent the average change per ten years of age. As detailed in the results section, a slightly different selection of LDS models is tested for PLI across chronological age.
Figure 9. Latent difference score structural model, including both additive and proportional change parameters (upper part; cf. McArdle, 2001; McArdle & Hamagami, 2001; McArdle & Nesselroade, 2003). Unlabeled paths are fixed at 1. Various structural models that are employed in this study can be derived from the general LDS model (lower part).
Bivariate constant change score (BCCS) model with cross-lagged coupling

\[ ob[t] = ob[t-1] + 0.20 \times S_{ob,i} + \gamma_{ob,op} \times \Delta op[t-1] \]

\[ op[t] = op[t-1] + 0.20 \times S_{op,i} + \gamma_{ob,op} \times \Delta ob[t-1] \]

**Figure 10.** Bivariate latent difference score structural model, including additive change parameters within variables as well as covariance and cross-lagged coupling across variables (cf. McArdle, 2001; McArdle & Hamagami, 2001; McArdle & Nesselroade, 2003). OB = Obligatory PLI, OP = Optional PLI. Unlabeled paths are fixed at 1.
Figure 11. Bivariate latent difference score structural model, including additive change parameters within variables as well as covariance and simultaneous coupling across variables. OB = Obligatory PLI, OP = Optional PLI. Unlabeled paths are fixed at 1.

Investigating longitudinal dynamics. In developmental research, one usually does not just describe change in one variable across time or age, but one also wants to know how different variables change together or influence each other across time. Here, we need to consider that the
observed change in two variables can reflect change within the variables, correlated change of the
two variables, and dynamic interrelations, such that one variable influences the other variable
across time. Once one expects to find change in both variables and also dynamic interrelations, it
is important to use a method that can capture both processes. Focusing only on the dynamics or
only on the changes may lead to different conclusions than focusing on the dynamics of change
(Ferrer & McArdle, 2003). Figure 10 depicts a bivariate LDS model that can account for both
change and dynamics (for more detailed descriptions and applications see Ghisletta & Lindenberg,
2003; Hamagami et al., 2000; McArdle, 2001; McArdle & Hamagami, 2001; McArdle &
Nesselroade, 2003). The bivariate latent difference score (BLDS) model is an extension of the
univariate model in Figure 9. LDS models for both obligatory PLI and optional PLI are specified.
To reduce the complexity of Figure 10, the quadratic slope factor QS was not included in the
picture, although it will be included in the analyses. Moreover, as autoproportional change is not
particularly interesting with PLI data, the β parameter was left out to reduce the complexity of
the model. Additional parameters in the BLDS model are covariances between the levels and
slopes of obligatory PLI and optional PLI and coupling parameters γ that tap the cross-lagged
effects of change in one variable on change in the other variable. The covariances capture the
concurrent relationships between obligatory PLI and optional PLI, while the coupling parameters
depict change in one variable as a leading indicator of change in the other variable (lagged
relationships). Both change in obligatory PLI as a leading indicator of change in optional PLI and
change in optional PLI as a leading indicator of change in obligatory PLI are included in the
model.

One possible limitation to employing the model in Figure 10 has been discussed in
section D4: If the timing and spacing of measurement occasions does not match with the
assumed timing of the causal process under study, trying to demonstrate cross-lagged effects can
be futile. If the interval between a putative cause and its putative effect is much shorter than the
interval between the repeated assessments, it may be better to focus on simultaneous rather than
lagged effects (Hertzog & Nesselroade, 2003). Following this rationale, the model in Figure 11
was specified in order to model simultaneous reciprocal effects between change in obligatory PLI
and change in optional PLI. The model is build on and combines bivariate LDS models
(McArdle, 2001; McArdle & Hamagami, 2001) and reciprocal effects models (e.g., Schooler &
Mulatu, 2001; Schooler et al., 1999). The BLDS model in Figure 11 differs from the BLDS model
in Figure 10 in two important ways. First, the slopes of obligatory PLI and optional PLI are not
allowed to correlate. Instead, the covariance between the slopes is split up into the effect of
change in obligatory PLI on change in optional PLI and the effect of change in optional PLI on
change in obligatory PLI (note that the respective γ paths are constrained to be equal across all
time points). Second, no cross-lagged $\gamma$ paths are included. That way, it is possible to determine the direction of causation between simultaneous changes in the two variables. Due to large time intervals in BASE, this model is theoretically more adequate for studying the relationship between change in obligatory PLI and change in optional PLI than the model in Figure 10.
H RESULTS

The three major questions of this study now will be addressed in three separate sections. First, analyses pertaining to the validation of PLI are presented. Hierarchical linear regressions and commonality analyses (Pedhazur, 1982) are performed to clarify the relations between the four PLI facets and other self-pragmatic constructs (i.e., personality dispositions, current and possible selves, and activities). Second, developmental trajectories across time-in-study of the four PLI facets are determined and the relationship between the development of obligatory PLI and optional PLI is investigated. With the longitudinal data, selectivity analyses for means and variances/covariances need to be conducted as a first step. The introduced latent difference score models (LDS models; e.g., McArdle, 2001; McArdle & Hamagami, 2001; McArdle & Nesselroade, 2003) are subsequently employed to identify longitudinal trajectories of PLI and to test for dynamic relations between obligatory and optional PLI. These analyses are performed with Mplus Version 2.02 (L. K. Muthén & Muthén, 1998). Furthermore, developmental trajectories across the entire age range in BASE are estimated with the longitudinal and cross-sectional data and are subsequently compared. LDS models and hierarchical linear regressions are used in the third major part of analyses on the relations between PLI, health, and satisfaction. These associations are studied both with initial scores at the first measurement occasion and with the estimated changes across ten years in BASE. It is tested whether initial levels of and changes in average PLI, PLI selectivity, and optional PLI moderate the association between initial levels of health and satisfaction and change in health and change in satisfaction.

1 Validation of Personal Life Investment

A “classical” strategy to external validation is to demonstrate the convergent and discriminant validity of a construct by employing a multitrait multimethod matrix (D. T. Campbell & Fiske, 1959). That is, to differentiate what a test measures from what it does not measure. Although different methods are involved in the present study (standard Likert scales vs. open response formats), this strategy is not applicable: Here, different constructs were assessed with different methods rather than the same construct with different methods. BASE also does not include constructs that have enough conceptual overlap with PLI to produce correlations in excess of .50. Thus, the alternative strategy employed here to validate the PLI construct is to identify elements of the self-system that can all be related to PLI on a theoretical basis. PLI, personality dispositions, current and possible selves, and activities are expected to show a small overlap in terms of the measured content (as illustrated in Figure 4, p. 50). The validity of PLI as
a self-regulatory construct can be seen in the independent portions of overlapping variance shared with personality dispositions, current and possible selves, and activities. Hypothesis 1a has been formulated as a general hypothesis that guides the analyses in this first part of the results section. It was predicted that personality dispositions, current and possible selves, and daily activities are related to average PLI, obligatory PLI, and optional PLI, and that current and possible selves and activities, but not personality dispositions, are related to PLI selectivity. Based on the above considerations, this hypothesis can be formulated more specifically. Namely, personality dispositions, current and possible selves, and daily activities are expected to account for independent portions of the variance in average PLI, obligatory PLI, and optional PLI, and current and possible selves and activities, but not personality dispositions, are expected to account for independent portions of the variance in PLI selectivity. In addition to hypothesis 1a, hypotheses 1b – 1g have been formulated to spell out the expected associations between individual variables in more detail. These hypotheses also serve to validate the differentiation between obligatory PLI and optional PLI.

Three major steps are taken to test hypotheses 1a – 1g. First, zero-order correlations (Table 6; Appendix B1) are inspected to identify variables to be included in the commonality analyses and check for possible sources of multicollinearity. Second, commonality analyses serve to determine the unique and shared portions of variance in the PLI facets accounted for by personality dispositions, current and possible selves, and activities (Figure 12). Third, beta weights of individual predictors (Table 7) are inspected to evaluate the more specific hypotheses on associations between individual variables and PLI. It is also determined which of the individual variables can account for independent portions of the variance in PLI facets.

Zero-order correlations. Table 6 reports correlations between the four PLI facets and personality dispositions, current and possible selves, and activities. The correlations that are central for hypotheses testing have been included in this table. A matrix including all variable intercorrelations can be found in Appendix B1. Correlations with age, as a potentially interesting control variable, have also been included in Table 6. As can be seen, correlations of the four PLI facets with personality dispositions, current and possible selves, activities, and age are generally small to moderate. It is also evident that not all of the predicted associations are present. Specifically, average PLI did not show the predicted association with the number of self-defining domains, \( r = .08, \text{ns} \). PLI selectivity showed only two significant correlations: One with

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11 Other control variables of potential interest, such as gender or socioeconomic status, could have been identified. Both gender and SES may provide some information regarding the amount of available resources. However, an additional discussion and analysis of the potential relationships between gender, SES, and PLI would not have been feasible within the present study. Moreover, associations between PLI facets and gender and SES are generally very small (\( r < .20 \)) and often nonsignificant. For these reasons, associations between PLI facets and gender or SES are not further pursued.
internal control beliefs, $r = .10$, and one with the number of self-definitions in obligatory life domains, $r = .12$ (Table 6). None of the predicted relations were found. Thus, the construct of PLI selectivity cannot be validated with the selected constructs and is not considered in the following commonality analyses. Also contrary to predictions, obligatory PLI was unrelated to the proportion of activities classified as obligatory, $r = .02$, ns. Finally, optional PLI failed to demonstrate the expected associations with internal control beliefs, $r = .08$, ns, and the number of hopes in optional domains, $r = -.01$, ns.

<table>
<thead>
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<th>Table 6</th>
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| Correlations between PLI Facets, Personality Dispositions, Current and Possible Selves, and Activities at T1 |
|------------------|------------------|------------------|------------------|
|                   | Average          | Selectivity      | Obligatory       | Optional         |
| Extraversion      | .27***           | .02              | .17***           | .30***           |
| Positive affect   | .46***           | .06              | .36***           | .39***           |
| Neuroticism       | .14***           | .03              | .22***           | -.02             |
| Negative affect   | .27***           | .03              | .32***           | .08              |
| Openness          | .36***           | .03              | .30***           | .30***           |
| Internal control  | .14***           | .10*             | .15**            | .08              |
| Number self-defining domains | .08           | .06                | .09*              | .00              |
| Number hopes      | .12**            | .01              | .09*             | .10*             |
| Number fears      | .13**            | .04              | .13**            | .04              |
| Number self-definitions obligatory domains | .00            | .12***            | .07               | -.10*            |
| Number self-definitions optional domains | .09*            | -.06             | .03               | .14**            |
| Number hopes obligatory domains | .12**            | .02              | .11*             | .08              |
| Number fears obligatory domains | .10*            | -.01            | .12**            | -.00             |
| Number hopes optional domains | -.05           | .00              | -.07             | -.01             |
| Fears optional domains | -.00           | .08              | -.04             | .06              |
| Duration total activity | .11*            | -.01             | .07               | .12**            |
| Obligatory activity | -.06           | .01              | .02               | .14**            |
| Optional activity | .21***           | -.06             | .12**            | .24***           |
| Age               | -.16***          | .08              | -.06             | -.23***          |

Note. Ns range between 484 and 511. Correlations between corresponding variables are printed in bold.

* Dichotomous variable (0 = no; 1 = yes).

*p < .05. **p < .01. ***p < .001.

Only variables that showed significant zero-order correlations with average PLI, obligatory PLI, or optional PLI were selected for the commonality analyses. Specifically, extraversion, positive affectivity, neuroticism, negative affectivity, openness, internal control beliefs, number of hopes, number of fears, and the duration of total activity were considered as predictors of average PLI (variables that have been created specifically for obligatory and optional life domains were not considered, as average PLI is a domain-general indicator). Extraversion, positive affectivity, neuroticism, negative affectivity, openness, internal control beliefs, number of self-defining domains, number of hopes in obligatory domains, and number of fears in obligatory
domains served as predictors of obligatory PLI. Extraversion, positive affectivity, openness, number of hopes, number of self-definitions in optional domains, the duration of total activity, and the proportion of activities in optional domains were employed as predictors of optional PLI.

*Commonality analyses* (Pedhazur, 1982) were conducted to determine unique and shared portions of overlapping variance between PLI facets, personality dispositions, current and possible selves, and activities. Commonality analysis requires to perform a series of hierarchical linear regressions. The independent variables are combined such that they form a set of steps to be entered in the regression. Then, one regression analysis for each possible permutation of steps needs to be run. Based on the explained variance in each step, unique and shared portions of predictive variance can be computed.

Here, three steps were chosen such that one step included all personality dispositions, another step included all current and possible selves, and yet another step included all activity variables. Where activity variables had shown no significant zero-order correlations with a PLI facet (i.e., for obligatory PLI), the commonality analysis was conducted with only two steps (personality variables and self-concept variables). The results of each of the six (or two) hierarchical regressions per PLI facet are presented in Appendix B2. The reported portions of explained variance per step were used to compute the common and unique shares of predictive variance. The resulting findings for average PLI, obligatory PLI, and optional PLI are summarized in Figure 12. Across all PLI facets, the larger part of the variance remained unaccounted for (between 70.2% and 77.9%). Personality measures accounted for the largest share of unique variance in each PLI facet (between 14.8% and 25.9%). However, some unique predictive variance was also left to other variables. With average PLI and obligatory PLI, current and possible selves accounted for a significant 1% – 2% of unique variance (Figure 12). Moreover, personality variables and self-concept variables also shared some predictive variance (average PLI: 1.5%; obligatory PLI: 1.4%). In contrast, current and possible selves did not account for unique variance in optional PLI, $\Delta R^2 = .01$, *ns* (cf. Appendix B2) but shared all of its predictive variance with personality and activity variables. As already mentioned, activities were unrelated to obligatory PLI. Furthermore, activity variables did not account for unique variance in average PLI, $\Delta R^2 = .00$, *ns* (cf. Appendix B2) but shared all of its predictive variance with personality and self-concept variables. Findings are somewhat different for optional PLI. Here, activities explained a significant 1.9% of unique variance and shared another 2.7% of variance with personality variables.
Overall, hypothesis 1a received partial support. Contrary to the hypothesis, PLI selectivity did not show the predicted associations with current and possible selves and activities. Furthermore, obligatory PLI was unrelated to activities. In accordance with the hypothesized pattern, both average PLI and optional PLI showed some associations with personality dispositions, current and possible selves, and activities. However, once rival predictors were considered, activities did not make a unique contribution to the prediction of average PLI and self-concept variables did not make a unique contribution to the prediction of optional PLI.

![Figure 12. Relations between PLI facets and other self-pragmatic constructs: Unique and shared portions of predictive variance of personality dispositions, current and possible selves, and activities (based on commonality analyses).](image)

**Multivariate relationships between PLI, personality dispositions, current and possible selves, and activities.** As Figure 12 was based on a combination of several variables in one step, the more specific hypotheses 1b – 1g cannot be addressed with the results reported thus far. Moreover, zero-order correlations alone are not very informative when it comes to the relative importance of individual variables in predicting PLI. Therefore, standardized and unstandardized regression weights for each variable included in the three commonality analyses are reported in Table 7. In addition, the unique contribution of each variable to the prediction of average PLI, obligatory
PLI, and optional PLI is reported (the amount of explained variance when the variable is entered in the regression after the remaining variables have been considered).  

Hypothesis 1b predicted positive associations of extraversion and positive affectivity with average PLI, obligatory PLI, and optional PLI, but only positive associations between neuroticism and negative affectivity and average PLI and obligatory PLI. Although zero-order correlations support the hypothesis for both extraversion and positive affectivity, only positive affectivity showed significant associations with all three PLI facets once rival predictors were considered. Dispositional positive affect also accounted for the largest portion of unique variance in each PLI facet (between 4% and 7%; Table 7). Extraversion only accounted for some unique variance in optional PLI (1%; Table 7). In accordance with hypothesis 1b, neuroticism and negative affectivity showed significant associations with all three PLI facets once rival predictors were considered. Dispositional positive affect also accounted for the largest portion of unique variance in each PLI facet (between 4% and 7%; Table 7). Extraversion only accounted for some unique variance in optional PLI (1%; Table 7). In accordance with hypothesis 1b, neuroticism and negative affectivity showed significant associations with all three PLI facets once rival predictors were considered. Dispositional positive affect also accounted for the largest portion of unique variance in each PLI facet (between 4% and 7%; Table 7). Extraversion only accounted for some unique variance in optional PLI (1%; Table 7). In accordance with hypothesis 1b, neuroticism and negative affectivity showed significant associations with all three PLI facets once rival predictors were considered. Dispositional positive affect also accounted for the largest portion of unique variance in each PLI facet (between 4% and 7%; Table 7).

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12 The regression analyses were also rerun with age included as a control variable. However, age did not receive a significant beta weight in any of the analyses when it was entered together with the remaining variables (average PLI: $\beta = -.01$, ns; obligatory PLI: $\beta = .05$, ns; optional PLI: $\beta = -.09$, $p = .05$) and the reported results remained unchanged: Associations between PLI, personality dispositions, self-concept variables, and activities did not vanish once age was considered. Therefore, regression analyses including age are not reported.
negative affectivity were positively related to average PLI and obligatory PLI but unrelated to optional PLI. But again, once rival predictors were considered, only negative affectivity was significantly related to average PLI and obligatory PLI, accounting for 2% – 3% of unique variance. Thus, the agentic and positive affective components of extraversion seem to account for most of the zero-order correlations between extraversion and PLI. Once positive affectivity\textsuperscript{13} was considered, extraversion lost its positive associations with most of the PLI facets. Similarly, the positive zero-order correlations between neuroticism and PLI seem to be attributable to the negative affective components of neuroticism. With negative affectivity as rival predictor considered, neuroticism was no longer related to PLI.

The hypothesis that openness is positively related to average PLI, obligatory PLI, and optional PLI (hypothesis 1c) was confirmed. Even when rival predictors were considered, openness remained predictive of the three PLI facets, explaining 1% – 3% of unique variance (Table 7). In contrast, hypothesis 1d, predicting positive associations between internal control beliefs and average PLI, obligatory PLI, and optional PLI was not confirmed: Zero-order correlations were small (or nonsignificant) and associations vanished when alternative variables were considered.

Hypothesis 1e stated that the number of self-defining domains is positively related to average PLI and negatively related to PLI selectivity and that the number of self-definitions in life domains classified as obligatory is positively related to obligatory PLI and the number of self-definitions in life domains classified as optional is positively related to optional PLI. Of all the predicted associations, only one was found: Optional PLI was correlated with the number of self-definitions in optional domains \((r = .14; \text{Table 6})\). Number of self-definitions in optional domains also remained a marginally significant predictor of optional PLI with rival predictors considered (explaining 1% of unique variance; Table 7). Nevertheless, associations between PLI facets and self-definitions were mostly nonsignificant. The overlap between these constructs was very small or absent.

In contrast to current selves (self-definings), possible selves demonstrated more associations with PLI. In support of hypothesis 1f, the number of hoped-for possible selves was correlated with average PLI, obligatory PLI, and optional PLI, whereas the number of feared possible selves was correlated with average PLI and obligatory PLI but was unrelated to optional PLI (Table 6). Only PLI selectivity did not demonstrate the expected associations with hopes and fears. With rival predictors considered, number of hopes—but not number of fears—remained predictive of average PLI and explained 1% of unique variance (Table 7). Both number of hopes

\textsuperscript{13} The PANAS items measuring positive affect do not just reflect positive affectivity but also agency, as indicated through items like “active” or “determined.”
in obligatory domains and number of fears in obligatory domains were related to obligatory PLI, even when alternative variables were considered. Each explained 1% of unique variance (Table 7). In the regression with optional PLI as dependent variable, number of hopes did not add to the prediction once alternative predictors were considered.

One additional percent of explained variance may not seem much. Here, inspection of the unstandardized regression weights (B) can provide an additional understanding of the size or importance of associations. The B value of 1.07 (Table 7) for number of hopes in the analysis with average PLI as dependent variable indicates that naming one additional hoped-for self was associated with 1.07 additional POMP units of average PLI. If we consider that average PLI at T1 had a standard deviation of 13.3 (Appendix A1), 2.5 additional hopes amount to a small effect (or an increase of 0.2 \( SD \) units; J. Cohen, 1977) on average PLI. The effect of 2.5 more hopes on average PLI is further equivalent to the effect of approximately 9 additional POMP units of positive affectivity. Similarly, with obligatory PLI as the dependent variable, the B values for the numbers of hopes and fears in obligatory domains indicate that one additional hope in obligatory domains was associated with 1.17 additional POMP units of obligatory PLI and that one additional fear in obligatory domains was associated with 1.43 additional POMP units of obligatory PLI. As obligatory PLI at T1 had a standard deviation of 16.1 (Appendix A1), about three additional hopes or about two additional fears amount to a small effect on obligatory PLI.

Finally, hypothesis 1g predicted that the total duration of activity is positively related to average PLI and negatively related to PLI selectivity and that performing more activities classified as obligatory is positively related to obligatory PLI and performing more activities classified as optional is positively related to optional PLI. Again, this hypothesis was only partially supported. With rival predictors considered, only the percentage of optional activities added to the prediction of optional PLI (\( \Delta R^2 = .02 \); Table 7). Here, about 22 additional POMP units of optional activities would have a small effect on optional PLI.

**Summary:** Validation of PLI. The results from the cross-sectional BASE sample (\( N = 511 \)) partially supported hypothesis 1a: Personality dispositions, current and possible selves, and also activities accounted for some portions of the variance in average PLI, obligatory PLI, and optional PLI. The notable exception was PLI selectivity, which was found to be unrelated to self-concept and activity variables. Moreover, not all variables accounted for variance in every PLI facet. Rather, personality dispositions and current and possible selves, but not activities, were related to obligatory PLI. Personality dispositions, current and possible selves, and activities were related to average PLI and optional PLI. However, only personality and self-concept variables...
accounted for unique variance in average PLI and only personality and activity variables accounted for unique variance in optional PLI.

The hypotheses pertaining to associations between PLI and personality dispositions (hypotheses 1b – 1d) were largely supported. As predicted, extraversion, positive affectivity, and openness were positively related to average PLI, obligatory PLI, and optional PLI and unrelated to PLI selectivity. Neuroticism and negative affectivity were positively related to average PLI and obligatory PLI but unrelated to optional PLI and PLI selectivity. The assumed association between obligatory PLI, but not optional PLI, and avoidance temperament was hence demonstrated, which adds to the validation of this distinction. Hypothesis 1d predicting positive associations between PLI and internal control beliefs was not supported. Although zero-order correlations between internal control beliefs and average PLI and obligatory PLI were significant, internal control beliefs lost their predictive power in the regression analyses.

Current and possible selves were also linked to PLI. Specifically, the current self-definition, but not possible selves, made a small contribution to the prediction of optional PLI. That is, optional PLI was related to who one is here and now rather than to future possible selves. In contrast, possible selves, but not the current self-definition, contributed to the prediction of average PLI and obligatory PLI. Self-concept variables were mostly unrelated to PLI selectivity. Overall, the findings lend only partial support to hypotheses 1e and 1f.

Finally, activity variables were only linked to optional PLI, but made no unique contribution to the prediction of average PLI or obligatory PLI. This again provided only partial support for hypothesis 1g, which predicted associations between all four PLI facets and activities.

It should be noted here that, by and large, the reported results also hold true in the longitudinal BASE sample (N = 206), which will be at the focus of the next set of analyses. For the interested reader, the information provided in Tables 6 and 7 is given for the reduced longitudinal sample in Appendix B3. As was to be expected, some associations do not reach significance due to the reduced sample size in the longitudinal sample but the sizes and signs of associations are similar.

2 Development and Dynamics of Personal Life Investment

Four major steps are taken to investigate the longitudinal development of the four PLI facets and the longitudinal dynamics between obligatory PLI and optional PLI. As a first step, I report selectivity analyses for means and variances and covariances of PLI to determine whether the longitudinal BASE sample (N = 206) represents a positive selection of the participants in the cross-sectional sample. Second, the observed individual data points and resulting means of the
four PLI facets at each two-year age interval are plotted for the longitudinal and cross-sectional samples. This allows for a first visual inspection of developmental trends and similarities and differences between the samples. In addition, rank-order stabilities of PLI are computed. In a third step, the latent difference score (LDS) models across time-in-study, which were introduced in section G5, are estimated and the best-fitting model for each PLI facet is determined. Subsequently, chronological age is included as a covariate in the best-fitting LDS models across time-in-study to test for age-related differences in initial levels and slopes of the PLI facets. With a last LDS model across time-in-study, I test for relationships between change in obligatory PLI and change in optional PLI. The fourth major step involves comparisons of different LDS models across age-at-measurement. Again, the best-fitting model for each PLI facet is determined. In a last set of analyses, the obtained mean trajectories of the longitudinal sample are compared to the developmental trends suggested by the cross-sectional T1 data.

a Selectivity Analyses

Participants in the longitudinal sample may represent a positive selection of the original BASE participants both in terms of mean levels and in terms of variability and correlational patterns. That is, as a group they may have reported higher PLI at T1 or they may have been less variable in their PLI ratings at T1. Both possibilities were investigated.

Selectivity with regard to means of PLI facets. Selectivity analyses were conducted as described by Lindenberger et al. (2002; see G4). Total selectivity was decomposed into mortality-associated selectivity and experimental selectivity (equations 3 and 4, p. 139). Selectivity effects were computed for the longitudinal T3 sample and also for the longitudinal T5 sample. Analyses for the T5 sample were included to determine the maximum amount of selectivity that can be observed with the PLI data. Based on the mortality information in BASE, four groups of T1 participants were identified: Participants who were still alive after data collection at T3 had been completed (in October 1996) formed the group of T3 survivors (n = 276). A subsample of the T3 survivors had participated in BASE at T3 and formed the T3 sample (n = 202). Similarly, participants who were still alive after data collection at T5 had been completed (in August 2001) are referred to as the T5 survivors (n = 134) and the subsample that had participated in BASE at T5 is the T5 sample (n = 80). Mortality-associated selectivity in the T3 sample was computed by comparing the T1 PLI data of the T3 survivors with the T1 data of the entire cross-sectional sample (N = 511). Experimental selectivity in the T3 sample was computed by comparing the T1 PLI data of the T3 sample (i.e., those 202 people who actually participated in T3) with the T1 data of all 276 T3 survivors. Computation of selectivity estimates for T5 was analogous. Selectivity effect sizes are expressed as the difference in mean T1 PLI scores between groups standardized on the standard
deviation units of the cross-sectional sample. Selectivity estimates for PLI were computed before and after statistically controlling for chronological age.

In addition to selectivity analyses for the total T3 sample, analyses were repeated for three age groups (70 – < 80, 80 – < 90, and 90 – 100 years at T1). These analyses were not conducted with the T5 sample as no participant aged 90 and older at T1 had participated in T5. Of the 171 T1 participants in their seventies, 140 had survived until T3 and 118 actually participated in T3. Ninety-eight of the 170 T1 participants aged 80 to under 90 years had survived until T3 and 65 participated in BASE. Of the participants who were 90 years and older at T1, only 38 out of 170 had survived and only 19 participated in BASE at T3. Age group-specific selectivity analyses were conducted separately for each age group. This means that mean differences were standardized on the standard deviation of the T1 PLI data of the cross-sectional participants of the respective age group. Therefore, selectivity effects across the three age groups do not add up to the selectivity effect for the total T3 sample. Age-partialed PLI data were also computed separately for each age group.

Figure 13 displays the observed mortality-associated and experimental selectivity effects for both zero-order PLI data and age-partialed PLI data in the T3 and T5 samples. Selectivity effects for average PLI were negligible in both samples and in each age group. The observed magnitude of total selectivity did not qualify as even a small effect (0.2 $SD$ units; J. Cohen, 1977). PLI selectivity also produced mostly negligible total selectivity effects in the T3 sample. However, results for the 38 oldest-old participants in the T3 sample (90 years and over) point to a better chance of survival and participation in BASE at T3 in participants who were more selective in their investment at T1 (total selectivity was 0.20 $SD$ units). This finding is in contrast to the selectivity estimates for the T5 sample, which point to a higher chance of survival and continued participation in participants who were less selective in their investment (total selectivity was -0.21 $SD$ units). It thus seems that survival was related to less PLI selectivity in young-old participants and to more PLI selectivity in the oldest-old participants. Given that PLI selectivity is viewed as adaptive when resources are very limited, which most likely is the case for most of the oldest old, old-old people may benefit from investing resources more selectively. In contrast, younger-old people, as a group, are not assumed to experience severe resource limitations that require high PLI selectivity. Those young-old people who have nevertheless experienced severe resource loss and hence are more selective in their investment (which is not typical of this age group), may also have a higher risk for mortality or debilitating illness.
Figure 13. Mortality-associated and experimental components of selectivity in the longitudinal BASE T3 and T5 samples relative to the cross-sectional T1 sample for zero-order and age-partialed PLI facets assessed at T1.
Regarding selectivity effects for obligatory PLI and optional PLI, hypothesis 2a was formulated. It was predicted that a small amount of mortality-associated selectivity is present for optional PLI but not for obligatory PLI and that mortality-associated selectivity in optional PLI vanishes when selectivity estimates are controlled for age. In support of this hypothesis, selectivity estimates for obligatory PLI are close to zero, while optional PLI shows a small total selectivity effect in the T3 sample (0.18 SD units) and a somewhat larger (but still small) total selectivity effect in the T5 sample (0.40 SD units). About 67% (T3 sample) and 60% (T5 sample) of this total amount of selectivity is due to mortality, indicating that participants with higher optional PLI at T1 were more likely to still be alive at T3 and T5. Mortality-associated selectivity effects for optional PLI were considerably reduced when optional PLI was regressed on age. Most of this selectivity can hence be attributed to older individuals having a higher likelihood to die and also reporting less optional PLI. Interestingly, when comparing the 19 participants aged 90 and older who participated in BASE at T3 with the 38 survivors in this age group a small experimental selectivity effect of 0.22 SD units was found. Thus, the oldest-old participants who became part of the T3 sample initially reported somewhat higher optional PLI than people who survived until T3 but did not participate in BASE. This may be due to somewhat better health in those oldest-old people who remained in the study compared to those who dropped out. Results on the development of optional PLI for these oldest-old participants thus probably cannot be generalized to other BASE participants over 90 years. In contrast, the T3 participants who were under 90 years at T1 can be considered as a representative selection among the initial participants with regard to PLI. Selectivity effects for all PLI facets were negligible.

Selectivity with regard to variances and covariances of PLI facets. In addition to higher or lower mean levels, reduced variances can occur as a result of sample attrition (e.g., Lindenberger et al., 1999; Lindenberger et al., 2002). These variance restrictions can further lead to attenuated covariances or correlations (e.g., Nesselroade, 1990; Nesselroade & Jones, 1991). Parallel to selectivity analyses for mean differences, the variances and covariances of PLI facets for the T3 and T5 survivors and T3 and T5 samples at T1 were compared to the variances and covariances that were obtained with the entire cross-sectional sample. Obligatory PLI and optional PLI are sub-facets of average PLI and by necessity highly correlated with average PLI. As the covariances between average PLI and obligatory PLI and optional PLI are thus of no interest to the selectivity analyses for covariances, the four PLI facets were split into two pairs of variables for which covariances have substantive meaning. Specifically, average PLI and PLI selectivity were combined in one set of analyses and obligatory PLI and optional PLI were combined in a second set of analyses. First, the variances and covariances of the two pairs of variables were computed for the entire T1 sample and separately for each age group in the T1 sample. It was then tested.
whether the variances and covariances in the T3 and T5 samples at T1 can be constrained equal to the observed variances and covariances in the T1 sample. These comparisons were carried out using Mplus.\textsuperscript{14} The results are summarized in Table 8.

### Table 8
Comparison of Models with Variances and Covariances of PLI Facets in the T3 and T5 Samples at T1 Not Constrained versus Constrained Equal to Variances and Covariances in the Cross-Sectional T1 Sample

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Statistic</th>
<th>-2LL</th>
<th>∆N Par.</th>
<th>p</th>
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</thead>
<tbody>
<tr>
<td><strong>Average PLI and PLI Selectivity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>T3 total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 276): unconstrained vs. constrained</td>
<td>5.6</td>
<td>3</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>Sample (n = 202): unconstrained vs. variances constrained equal</td>
<td>5.0</td>
<td>2</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>Sample (n = 202): unconstrained vs. constrained</td>
<td>8.5</td>
<td>3</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td><strong>T3 per age group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors 70 – &lt; 80 years (n = 140): unconstrained vs. constrained</td>
<td>1.1</td>
<td>3</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td>Sample 70 – &lt; 80 years (n = 118): unconstrained vs. constrained</td>
<td>0.5</td>
<td>3</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td>Survivors 80 – &lt; 90 years (n = 98): unconstrained vs. constrained</td>
<td>0.5</td>
<td>3</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td>Sample 80 – &lt; 90 years (n = 65): unconstrained vs. constrained</td>
<td>0.7</td>
<td>3</td>
<td>.87</td>
<td></td>
</tr>
<tr>
<td>Survivors 90 – 100 years (n = 38): unconstrained vs. constrained</td>
<td>0.5</td>
<td>3</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td>Sample 90 – 100 years (n = 19): unconstrained vs. constrained</td>
<td>3.0</td>
<td>3</td>
<td>.39</td>
<td></td>
</tr>
<tr>
<td><strong>T5 total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 134): unconstrained vs. variance in PLI selectivity</td>
<td>1.2</td>
<td>1</td>
<td>.27</td>
<td></td>
</tr>
<tr>
<td>constrained equal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 134): unconstrained vs. variances constrained equal</td>
<td>7.9</td>
<td>2</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 134): unconstrained vs. constrained</td>
<td>16.0</td>
<td>3</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>Sample (n = 80): unconstrained vs. variances constrained equal</td>
<td>3.8</td>
<td>2</td>
<td>.15</td>
<td></td>
</tr>
<tr>
<td>Sample (n = 80): unconstrained vs. constrained</td>
<td>9.6</td>
<td>3</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td><strong>Obligatory PLI and Optional PLI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>T3 total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 276): unconstrained vs. constrained</td>
<td>5.7</td>
<td>3</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>Sample (n = 202): unconstrained vs. constrained</td>
<td>4.9</td>
<td>3</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td><strong>T3 per age group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors 70 – &lt; 80 years (n = 140): unconstrained vs. constrained</td>
<td>0.4</td>
<td>3</td>
<td>.94</td>
<td></td>
</tr>
<tr>
<td>Sample 70 – &lt; 80 years (n = 118): unconstrained vs. constrained</td>
<td>1.2</td>
<td>3</td>
<td>.75</td>
<td></td>
</tr>
<tr>
<td>Survivors 80 – &lt; 90 years (n = 98): unconstrained vs. constrained</td>
<td>1.9</td>
<td>3</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>Sample 80 – &lt; 90 years (n = 65): unconstrained vs. constrained</td>
<td>0.5</td>
<td>3</td>
<td>.92</td>
<td></td>
</tr>
<tr>
<td>Survivors 90 – 100 years (n = 38): unconstrained vs. constrained</td>
<td>4.9</td>
<td>3</td>
<td>.18</td>
<td></td>
</tr>
<tr>
<td>Sample 90 – 100 years (n = 19): unconstrained vs. constrained</td>
<td>4.5</td>
<td>3</td>
<td>.21</td>
<td></td>
</tr>
<tr>
<td><strong>T5 total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 134): unconstrained vs. variance in obligatory PLI</td>
<td>4.0</td>
<td>1</td>
<td>&lt; .05</td>
<td></td>
</tr>
<tr>
<td>constrained equal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 134): unconstrained vs. variance in optional PLI</td>
<td>4.3</td>
<td>1</td>
<td>.04</td>
<td></td>
</tr>
<tr>
<td>constrained equal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 134): unconstrained vs. variances constrained equal</td>
<td>8.0</td>
<td>2</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>Survivors (n = 134): unconstrained vs. constrained</td>
<td>9.2</td>
<td>3</td>
<td>.03</td>
<td></td>
</tr>
<tr>
<td>Sample (n = 80): unconstrained vs. constrained</td>
<td>4.0</td>
<td>3</td>
<td>.26</td>
<td></td>
</tr>
</tbody>
</table>

\textit{Note.} -2LL = \(-2 \times \) log-likelihood of model; N Par. = Number of Parameters.

\textsuperscript{14} As some participants had missing data on some PLI items and hence no values for PLI selectivity, the missing data option in Mplus was used to include all participants in these analyses.
For average PLI and PLI selectivity, the results from the total T3 and T5 samples suggest that the variances of the two PLI facets can be considered equal to the variances in the overall T1 sample. However, the covariance between average PLI and PLI selectivity differed, $\chi^2(3) = 8.5, p < .05$ (Table 8). A correlation of $r = -.03, p = .58$, between average PLI and PLI selectivity was obtained with the overall T1 sample, whereas the correlation in the T3 sample at T1 was $r = -.15, p < .05$, and the correlation in the T5 sample at T1 was $r = -.28, p < .05$. Once the T3 sample was split into three age groups, no indications of different variances or covariances between the T3 and T1 samples were found. Note, however, that the results for participants aged over 90 years need to be interpreted with caution as this sample is so small that even large differences may not reach significance. Still, when we compare the standard deviations in the overall T1 sample over 90 years with those from the T3 survivors and T3 sample over 90 years we do not see much difference: $SD$ for average PLI was 13.9 in the T1 sample, 13.2 in the T3 survivors, and 14.0 in the T3 sample; $SD$ for PLI selectivity was 8.0 in the T1 sample, 8.0 in the T3 survivors, and 6.9 in the T3 sample. The picture changes once the correlations between average PLI and PLI selectivity are considered: The correlations were $r = .07, p = .41$ in the T1 sample, $r = -.02, p = .92$ in the T3 survivors, and $r = -.28, p = .27$ in the T3 sample. Although the correlation for the T3 sample over 90 years did not reach significance, its size is more similar to the correlation obtained with younger participants ($r = -.18, p < .05$ for the T1 sample under 80 years).

With regard to obligatory PLI and optional PLI, the comparisons of the T1 sample with the total T3 and T5 survivors and samples mostly indicated equal variances and covariances. The exception are the T5 survivors, where tests indicated that both variances and also the covariance between obligatory PLI and optional PLI differed from those in the T1 sample (Table 8). Compared to the T1 sample (obligatory PLI: $SD = 16.1$; optional PLI: $SD = 17.2$, $r = .32$, $p < .001$) variances at T1 were smaller and the covariance at T1 was attenuated in the T5 survivors (obligatory PLI: $SD = 14.2$; optional PLI: $SD = 15.1$; $r = .15, p = .08$). The investigation of the three age groups for the T3 survivors and samples again yielded no significant differences, suggesting that sample attrition did not alter the variances and covariance of obligatory PLI and optional PLI in each age group. Again, it seems necessary to take a closer look at the data of the participants over 90 years. Compared to the T1 sample over 90 (obligatory PLI: $SD = 16.7$; optional PLI: $SD = 17.6$, $r = .33, p < .001$) the T3 survivors (obligatory PLI: $SD = 16.1$; optional PLI: $SD = 20.3$, $r = .10, p = .54$) and T3 sample (obligatory PLI: $SD = 17.9$; optional PLI: $SD = 21.7$, $r = .06, p = .82$) had numerically larger variances in optional PLI but also numerically lower correlations between obligatory PLI and optional PLI. Although none of these differences reached significance in the very small samples over 90 years, it seems important to note that the correlational patterns obtained with both the oldest-old participants who
survived until T3 and those who actually participated in T3 again look more similar to the correalional pattern obtained with younger-old participants \( (r = .21, p < .01 \) for participants under 80 years) than to that of their non-surviving age peers at T1.

Overall, it seems justified to conclude that the total T3 and T5 samples do not differ from the T1 sample with regard to the variances of average PLI, PLI selectivity, obligatory PLI, and optional PLI at T1. Differences have been found for the covariance between average PLI and PLI selectivity, indicating a significant negative covariance in the T3 and T5 samples but no covariance in the T1 sample. Nevertheless, this difference can be attributed to the changing age composition of the BASE sample over time, such that younger participants were more likely to remain in the sample and also showed a more negative association between average PLI and PLI selectivity. The correlation between average PLI and PLI selectivity in the T3 sample \( (r = -.15) \) was pretty much identical to the respective correlation in the T1 sample under 80 years \( (r = -.18) \). When age groups were considered separately, there was no indication of selective attrition with regard to variances and covariances in the T3 sample. This observation also holds for the oldest-old participants over 90 years. However, due to the very small sample size these results may not be reliable. Inspection of the variances and covariances pointed to largely unchanged variances compared to the T1 sample over 90 years but to covariances that look more similar to those obtained with younger-old participants. Thus, like the selectivity analyses for mean scores, these analyses again suggest that the participants in the T3 sample who were above 90 years at T1 represent a positive selection among the initial participants aged 90 and older.

b A First Inspection of Changes in Mean Levels and Rank-Order Stabilities

Before average developmental trajectories of the four PLI facets are estimated, the next sections provide an overview of the observed longitudinal and cross-sectional PLI data. To familiarize the reader with the data set, individual longitudinal trajectories and cross-sectional T1 data of each participant are plotted. In addition, rank-order stabilities of the four PLI facets are reported and hypothesis 2b referring to rank-order stabilities of obligatory PLI and optional PLI is tested.

Individual and average trajectories of PLI. Figures 14 to 17 depict the developmental trajectories for each participant in the longitudinal sample (upper panels) and the PLI scores for each participant in the cross-sectional sample (lower panels) ordered along the dimension of chronological age. In addition, a gray line has been drawn that indicates the observed mean values at each two-year age interval. Across all figures, the dominant picture is no or only little systematic change in observed means across age and simultaneously considerable variability in initial levels
Figure 14. Observed developmental trajectories of average PLI across age.
**Figure 15.** Observed developmental trajectories of PLI selectivity across age.
Figure 16. Observed developmental trajectories of obligatory PLI across age.
Figure 17. Observed developmental trajectories of optional PLI across age.
and change patterns. Moreover, the longitudinal trajectories do not show substantial departures from the cross-sectional trajectories. Once we take a closer look, we find that optional PLI is the only PLI facet for which a slight decline in average levels across age is evident. The cross-sectional optional PLI data further suggest that this decline may not be linear. Rather, optional PLI appears to be stable up to about age 80, to decline between 80 and 90 years, and to be relatively stable on a reduced level beginning at age 90. The latent difference score models to be computed subsequently will shed more light on the exact change patterns of PLI in both samples.

**Rank-order stabilities** between T1 and T3, T3 and T4, and T4 and T5 were computed to determine the stability of interindividual differences in the PLI facets. The individual stability estimates and an overall stability estimate averaging across the three stability coefficients are presented in Table 9. The overall stability estimate was computed after Fisher’s Z-transformation of the individual correlations. The impact of individual correlations was further weighted according to sample size (cf. Bortz, 1993): Correlations from bigger samples have a stronger impact on the averaged correlation. The correlations that were obtained after re-transforming the resulting Fisher’s Z-scores are reported. Mean rank-order stabilities of average PLI, obligatory PLI, and optional PLI were around .60, thus indicating a moderate amount of stability. PLI selectivity was slightly less stable than the other PLI facets but still showed a moderate amount of stability (mean \( r = .51 \)).

### Table 9

**Rank-Order Stabilities of PLI Facets**

<table>
<thead>
<tr>
<th>PLI Facet</th>
<th>T1 to T3 (MDistance = 3.8 years)</th>
<th>T3 to T4 (MDistance = 1.8 years)</th>
<th>T4 to T5 (MDistance = 3.4 years)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average PLI</td>
<td>.59***</td>
<td>.66***</td>
<td>.64***</td>
<td>.62 ***</td>
</tr>
<tr>
<td>PLI Selectivity</td>
<td>.43***</td>
<td>.53***</td>
<td>.64***</td>
<td>.51 ***</td>
</tr>
<tr>
<td>Obligatory PLI</td>
<td>.59***</td>
<td>.59***</td>
<td>.63***</td>
<td>.60 ***</td>
</tr>
<tr>
<td>Optional PLI</td>
<td>.58 ***</td>
<td>.65 ***</td>
<td>.55 ***</td>
<td>.60 ***</td>
</tr>
</tbody>
</table>

***\( p < .001 \).**

Rank-order stabilities between T1 and T3 were also computed separately for participants in their seventies, eighties, and nineties (Table 10). Stabilities of average PLI and obligatory PLI seem to increase with increasing age. However, the stability estimates for participants in their seventies are not significantly different from the stability estimates for participants in their nineties (average PLI: \( z = -1.04, p = .30 \); obligatory PLI: \( z = -1.59, p = .11 \)). Similarly, the declining tendency in stability estimates for optional PLI is not significant when septuagenarians
are compared to nonagenarians, $\zeta = 0.59, p = .56$. PLI selectivity was moderately stable in participants in their seventies and eighties but unstable in nonagenarians ($r = -.01$). Here, the difference between stability estimates for septuagenarians and nonagenarians was marginally significant, $\zeta = 1.93, p = .05$. As only 19 of the BASE participants aged 90+ years at T1 took part in the longitudinal study, the apparent differences in stability estimates need to be interpreted with caution. In sum, stability estimates for average PLI, obligatory PLI, and optional PLI demonstrated no significant differences between age groups and thus can be considered as equal. In contrast, PLI selectivity was unstable in the oldest-old participants but moderately stable in younger-old participants.

Table 10
Rank-Order Stabilities of PLI Facets between T1 and T3 by Age Group

<table>
<thead>
<tr>
<th>PLI Facet</th>
<th>70 – &lt; 80 years</th>
<th>80 – &lt; 90 years</th>
<th>90 – 100 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average PLI</td>
<td>.53***</td>
<td>.65***</td>
<td>.70**</td>
</tr>
<tr>
<td>PLI Selectivity</td>
<td>.49***</td>
<td>.50***</td>
<td>-.01</td>
</tr>
<tr>
<td>Obligatory PLI</td>
<td>.50***</td>
<td>.65***</td>
<td>.75***</td>
</tr>
<tr>
<td>Optional PLI</td>
<td>.60***</td>
<td>.57***</td>
<td>.49*</td>
</tr>
</tbody>
</table>

***$p < .001$. **$p < .01$. *$p < .05$. 

According to hypothesis 2b, rank-order stabilities of optional PLI decline with increasing time intervals between measurement occasions, while rank-order stabilities of obligatory PLI do not show systematic variations with length of measurement interval. Only the T5 sample ($n = 79 – 80$) was employed to test this prediction. Here, we can be sure that the differences between rank-order stabilities are attributable to larger time intervals and not to a changing sample composition. Rank-order stabilities were again computed for obligatory PLI and optional PLI, but this time between T1 and T3 ($M_{\text{Distance}} = 3.8$ years), T1 and T4 ($M_{\text{Distance}} = 5.5$ years), and T1 and T5 ($M_{\text{Distance}} = 9.0$ years). For obligatory PLI those stabilities were $r_{T1, T3} = .45, p < .01$, $r_{T1, T4} = .52, p < .01$, and $r_{T1, T5} = .46, p < .01$. To determine whether correlations across larger time intervals were smaller, the difference between $r_{T1, T3}$ and $r_{T1, T5}$ was tested for significance. There was no significant difference between these correlations for obligatory PLI, $\zeta = 0.10, p = .92$. The respective correlations for optional PLI were $r_{T1, T3} = .65, p < .01$, $r_{T1, T4} = .59, p < .01$, and $r_{T1, T5} = .38, p < .01$. Here, the difference between $r_{T1, T3}$ and $r_{T1, T5}$ was significant, $\zeta = 3.43, p < .01$. Thus, optional PLI, but not obligatory PLI, demonstrated decreasing rank-order stabilities with increasing time intervals. This can be interpreted as a first hint at developmental differences between the two PLI facets. Optional PLI may show differential but
still systematic intraindividual development. In contrast, obligatory PLI seems to exhibit more state-like fluctuations that are not indicative of differential intraindividual development.

c Latent Difference Score Models for PLI Facets Across Time-in-Study

In the following, development of the four PLI facets is described and studied along the dimension of time-in-study. This perspective allows to focus on interindivudual differences in intraindividual trajectories in BASE. For each participant, his or her individual level at T1 and slope across up to 10 years is determined regardless of the participant’s age. The latent difference score (LDS) models, which have been introduced in section G5, are employed to simultaneously estimate an average trajectory for the entire longitudinal sample and determine the amount of variability in initial levels and slopes. The 206 participants in the longitudinal sample were observed on at least two and at most four measurement occasions. The LDS models are hence based on a total of 603 to 619 individual PLI assessments.

LDS models across time in the longitudinal sample. For each PLI facet, a succession of nested LDS models was tested (cf. Figure 9, p. 145). As described in G5, analyses started with a baseline model and then the complexity of the model was increased step by step (cf. Ghisletta & McArdle, 2001). The first LDS model fitted was always a no change score (NCS) model that assumes some interindividual variability in an average level of PLI but no mean level change across time or variability in change across time. The second model was a constant change score (CCS) model that includes a linear slope and some variability in linear slopes in addition to varying levels. This model was first fitted with the covariance between initial level and slope set to 0 and then with the covariance to be estimated. In the next step, it was tested whether the addition of a quadratic slope improves the model fit, that is, a quadratic change score model (QCS) was employed. Following that, the change function was not specified as linear or quadratic but allowed to be estimated in a latent change score model (LCS). And finally, two models were fitted that include proportional change in PLI (the \( \beta \) parameter in Figure 9). A proportional change score model (PCS) that allows for only proportional change but no additive change was estimated first. Then, it was tested whether the addition of a proportional change parameter can further improve the fit of a CCS model. The resulting dual change score model (DCS) includes linear additive change and proportional change.
Table 11
Comparison of Different Latent Difference Score (LDS) Models for PLI Facets Across Time-in-Study

<table>
<thead>
<tr>
<th>Model</th>
<th>Statistic</th>
<th>-2LL</th>
<th>N Par.</th>
<th>∆-2LL</th>
<th>AN Par.</th>
<th>p</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average PLI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
<td></td>
<td>4,658.8</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>4,664.8</td>
<td>4,674.8</td>
</tr>
<tr>
<td>2: CCS without r</td>
<td></td>
<td>4,651.8</td>
<td>5</td>
<td>∆ vs. 1: 7.0</td>
<td>2</td>
<td>.03</td>
<td>4,661.8</td>
<td>4,678.4</td>
</tr>
<tr>
<td>3: CCS</td>
<td></td>
<td>4,650.8</td>
<td>6</td>
<td>∆ vs. 2: 1.0</td>
<td>1</td>
<td>.32</td>
<td>4,662.8</td>
<td>4,682.8</td>
</tr>
<tr>
<td>4: QCS without r</td>
<td></td>
<td>4,650.1</td>
<td>7</td>
<td>∆ vs. 2: 1.7</td>
<td>2</td>
<td>.43</td>
<td>4,664.1</td>
<td>4,687.4</td>
</tr>
<tr>
<td>5: LCS without r</td>
<td></td>
<td>4,651.3</td>
<td>8</td>
<td>∆ vs. 2: 0.5</td>
<td>3</td>
<td>.92</td>
<td>4,667.3</td>
<td>4,693.9</td>
</tr>
<tr>
<td>6: PCS</td>
<td></td>
<td>4,658.4</td>
<td>4</td>
<td>∆ vs. 2: 6.6</td>
<td>1</td>
<td>.01</td>
<td>4,666.4</td>
<td>4,679.7</td>
</tr>
<tr>
<td>7: DCS without r</td>
<td></td>
<td>4,650.8</td>
<td>6</td>
<td>∆ vs. 2: 1.0</td>
<td>1</td>
<td>.32</td>
<td>4,662.8</td>
<td>4,682.8</td>
</tr>
<tr>
<td><strong>PLI Selectivity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
<td></td>
<td>3,965.4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3,971.4</td>
<td>3,981.4</td>
</tr>
<tr>
<td>2: CCS without r</td>
<td></td>
<td>3,959.0</td>
<td>5</td>
<td>∆ vs. 1: 6.4</td>
<td>2</td>
<td>.04</td>
<td>3,969.0</td>
<td>3,985.6</td>
</tr>
<tr>
<td>3: CCS</td>
<td></td>
<td>3,957.9</td>
<td>6</td>
<td>∆ vs. 2: 1.1</td>
<td>1</td>
<td>.29</td>
<td>3,969.9</td>
<td>3,989.9</td>
</tr>
<tr>
<td>4: QCS without SD QS and r</td>
<td></td>
<td>3,955.6</td>
<td>6</td>
<td>∆ vs. 2: 3.4</td>
<td>1</td>
<td>.07</td>
<td>3,967.6</td>
<td>3,987.6</td>
</tr>
<tr>
<td>5: LCS without r</td>
<td></td>
<td>3,951.4</td>
<td>8</td>
<td>∆ vs. 2: 7.6</td>
<td>3</td>
<td>.06</td>
<td>3,967.4</td>
<td>3,994.0</td>
</tr>
<tr>
<td>6: PCS</td>
<td></td>
<td>3,963.4</td>
<td>4</td>
<td>∆ vs. 2: 4.4</td>
<td>1</td>
<td>.04</td>
<td>3,971.4</td>
<td>3,984.7</td>
</tr>
<tr>
<td>7: DCS without r</td>
<td></td>
<td>3,958.3</td>
<td>6</td>
<td>∆ vs. 2: 0.7</td>
<td>1</td>
<td>.40</td>
<td>3,970.3</td>
<td>3,990.3</td>
</tr>
<tr>
<td><strong>Obligatory PLI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
<td></td>
<td>4,884.2</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>4,890.2</td>
<td>4,900.2</td>
</tr>
<tr>
<td>2: CCS without r</td>
<td></td>
<td>4,880.2</td>
<td>5</td>
<td>∆ vs. 1: 4.0</td>
<td>2</td>
<td>.14</td>
<td>4,890.2</td>
<td>4,906.8</td>
</tr>
<tr>
<td>3: CCS</td>
<td></td>
<td>4,875.5</td>
<td>6</td>
<td>∆ vs. 1: 8.7</td>
<td>3</td>
<td>.03</td>
<td>4,887.5</td>
<td>4,907.5</td>
</tr>
<tr>
<td>4: QCS without SD QS and r involving QS</td>
<td></td>
<td>4,875.5</td>
<td>7</td>
<td>∆ vs. 3: 0.0</td>
<td>1</td>
<td>1.00</td>
<td>4,889.5</td>
<td>4,912.8</td>
</tr>
<tr>
<td>5: LCS</td>
<td></td>
<td>4,875.5</td>
<td>9</td>
<td>∆ vs. 3: 0.0</td>
<td>3</td>
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<td>4,893.5</td>
<td>4,923.4</td>
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<tr>
<td>6: PCS</td>
<td></td>
<td>4,882.8</td>
<td>4</td>
<td>∆ vs. 3: 7.3</td>
<td>2</td>
<td>.03</td>
<td>4,890.8</td>
<td>4,904.1</td>
</tr>
<tr>
<td>7: DCS</td>
<td></td>
<td>4,875.5</td>
<td>7</td>
<td>∆ vs. 3: 0.0</td>
<td>1</td>
<td>1.00</td>
<td>4,889.5</td>
<td>4,912.8</td>
</tr>
<tr>
<td><strong>Optional PLI</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>1: NCS</td>
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<td></td>
<td>5,042.0</td>
<td>5,051.9</td>
</tr>
<tr>
<td>2: CCS without r</td>
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<td>5,029.6</td>
<td>5</td>
<td>∆ vs. 1: 6.4</td>
<td>2</td>
<td>.04</td>
<td>5,039.6</td>
<td>5,056.3</td>
</tr>
<tr>
<td>3: CCS</td>
<td></td>
<td>5,025.2</td>
<td>6</td>
<td>∆ vs. 2: 4.4</td>
<td>1</td>
<td>.04</td>
<td>5,037.2</td>
<td>5,057.1</td>
</tr>
<tr>
<td>4: QCS without SD QS and r involving QS</td>
<td></td>
<td>5,018.4</td>
<td>7</td>
<td>∆ vs. 3: 6.8</td>
<td>1</td>
<td>.01</td>
<td>5,032.4</td>
<td>5,055.7</td>
</tr>
<tr>
<td>5: QCS without r involving QS</td>
<td></td>
<td>5,018.7</td>
<td>8</td>
<td>∆ vs. 4: 0.3</td>
<td>1</td>
<td>1.00</td>
<td>5,034.6</td>
<td>5,061.3</td>
</tr>
<tr>
<td>6: LCS</td>
<td></td>
<td>5,023.6</td>
<td>9</td>
<td>∆ vs. 4: 5.2</td>
<td>2</td>
<td>1.00</td>
<td>5,041.6</td>
<td>5,071.6</td>
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<tr>
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<td></td>
<td>5,035.3</td>
<td>4</td>
<td>∆ vs. 4: 16.9</td>
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<td>.00</td>
<td>5,043.3</td>
<td>5,056.6</td>
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<tr>
<td>8: DCS</td>
<td></td>
<td>5,024.8</td>
<td>7</td>
<td>∆ vs. 4: 6.4</td>
<td>0</td>
<td>1.00</td>
<td>5,038.8</td>
<td>5,062.1</td>
</tr>
</tbody>
</table>

Note. Best-fitting models are printed in italics. NCS = No Change Score; CCS = Constant Change Score; QCS = Quadratic Change Score; LCS = Latent Change Score; PCS = Proportional Change Score; DCS = Dual Change Score; -2LL = -2 × log-likelihood of model; N Par. = Number of Parameters; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.
The fit statistics of the different LDS models for the four PLI facets are presented in Table 11. Models are compared on the basis of the reported -2LL values. As the reader may remember, the difference between the -2LL values (Δ-2LL) of two nested models is χ²-distributed with degrees of freedom equal to the difference between the number of estimated parameters (ΔN Par.). In addition, model comparisons can be based on the reported information criteria. Smaller values of AIC and BIC indicate better model fit. As can be seen, the CCS model without a correlation between level and slope yielded a better fit than the NCS model for average PLI, χ²(2) = 7.0, *p* < .05, PLI selectivity, χ²(2) = 6.4, *p* < .05, and optional PLI, χ²(2) = 6.4, *p* < .05. The CCS models also produced lower AIC values compared to the NCS models. However, BIC values slightly increased with the CCS models. Given that BIC favors models with fewer parameters than AIC, that is, it involves a larger penalty for each additional parameter (e.g., Sclove, 1987), this result is not surprising. Still, this finding indicates that the differences between the NCS and CCS models are significant but not large.

For average PLI and PLI selectivity the CCS model without correlation also proved to be the best-fitting model. None of the alternative, more complex models significantly improved the fit to the data (Table 11). For obligatory PLI, a full CCS model (with correlation between level and slope) showed the best fit. The most complex best-fitting model was found for optional PLI. Here, the addition of a quadratic slope significantly improved the fit compared to a full CCS model, χ²(1) = 6.8, *p* < .05. Note however, that this quadratic slope has no variance, that is, each participant receives an identical quadratic slope parameter.

<p>| Table 12 |
| Parameter Estimates for Best-Fitting LDS Models Across Time-in-Study |</p>
<table>
<thead>
<tr>
<th>PLI Facet</th>
<th>M Level (SD)</th>
<th>M Linear Slope (SD)</th>
<th>M Quadratic Slope (SD)</th>
<th>SD Error</th>
<th>r(level, linear slope)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average PLI</td>
<td>54.1 (9.4)</td>
<td>0.3 (6.9)</td>
<td>---</td>
<td>7.5</td>
<td>---</td>
</tr>
<tr>
<td>PLI Selectivity</td>
<td>26.8 (4.8)</td>
<td>-1.3 (3.7)</td>
<td>---</td>
<td>5.0</td>
<td>---</td>
</tr>
<tr>
<td>Obligatory PLI</td>
<td>60.0 (12.5)</td>
<td>1.5 (9.7)</td>
<td>---</td>
<td>8.9</td>
<td>-.43</td>
</tr>
<tr>
<td>Optional PLI</td>
<td>46.1 (13.4)</td>
<td>-10.1 (13.2)</td>
<td>11.4 (---)</td>
<td>9.9</td>
<td>-.43</td>
</tr>
</tbody>
</table>

*Note.* Dashed lines indicate parameters that have not been estimated.

The parameter estimates for the best-fitting models are presented in Table 12. Mean average PLI at T1 was 54.1 POMP units and the mean change across ten years in study was 0.3 POMP units. The 95% confidence interval for the slope mean was -1.9 – 2.5 POMP units. Thus, in line with hypothesis 2d, there was no mean level change in average PLI across time-in-study. Nevertheless, the linear slope had some variability (SD = 6.9), which shows that there was
change in average PLI for individual participants: Some reduced, some did not change, and some increased their average PLI. This is illustrated in Figure 18 (panel A), where the estimated trajectories for ten participants are depicted in addition to the estimated mean trajectory.

![Figure 18](image.png)

*Figure 18.* Development of PLI facets across time-in-study. The estimated average trajectory (black) and estimated trajectories for ten individual participants (gray) are shown.

The observation of no mean level change but variability in change also holds true for PLI selectivity, $M_{slope} = -1.3$, 95% CI (-2.7; 0.2) (Figure 18, panel B) and obligatory PLI, $M_{slope} = 1.5$, 95% CI (-1.2; 4.3) (Figure 18, panel C)—which supports hypotheses 2e and 2f predicting no average-level change in these two PLI facets across time-in-study. The picture for optional PLI is somewhat more complicated. Both the linear slope and the quadratic slope were significantly different from zero ($M_{lin.\,slope} = -10.1$, 95% CI [-17.5; -2.8]; $M_{quad.\,slope} = 11.4$, 95% CI [2.9; 19.8]) but annihilated each other such that, in effect, there was no mean level change across ten years. The hypothesized overall declining trend for optional PLI (hypothesis 2g) was hence not found.
On an individual level, there were again people who reduced or did not change their optional PLI but also people who increased optional PLI (Figure 18, panel D). When we take a look at the standard deviations of levels and slopes (Table 12), we find that optional PLI showed the highest variability in both levels and slopes, which again supports the notion that optional life domains allow for more degrees of freedom.

The reported results have been obtained with the combined longitudinal sample, that is, participants with two, three, and four PLI assessments. It was assumed that development in all these participants can be described by the same change function. However, an open question is whether this assumption actually holds true: Did the 81 T5 participants develop like those participants who took part in the longitudinal study but dropped out of BASE before T5 or did they develop differently? As this question pertains to the generalizability of results, it is addressed in Appendix C1. Comparisons of the combined T3 and T4 sample with the T5 sample show that the means and standard deviations of initial levels and slopes of all four PLI facets can be considered as equal in both samples. That is, all longitudinal participants indeed can be described by the same change function across time-in-study.

Testing for associations between levels, slopes, and age. Up to now, participants’ age has not been considered in the LDS models across time-in-study. In addition to the LDS models across age-at-measurement that will be reported subsequently, inclusion of age as a covariate in the LDS models across time-in-study can provide some interesting information regarding age-related differences in individual trajectories. Thus, chronological age was included in the best-fitting LDS models to determine whether age can account for some of the variance in levels and slopes. In a first step, age was included in the model but no associations between age and level or linear slope were allowed. In a second step, a path between age and the initial level was specified. In a third step, a path between age and the linear slope, but no path between age and level, was included. Both level and slope of average PLI were found to be unrelated to age (no relation vs. age related to level: \( \chi^2[1] = 2.7, \text{ns} \); no relation vs. age related to slope: \( \chi^2[1] = 0.0, \text{ns} \)). The same held true for obligatory PLI: Neither level nor slope were related to age (no relation vs. age related to level: \( \chi^2[1] = 0.1, \text{ns} \); no relation vs. age related to slope: \( \chi^2[1] = 0.0, \text{ns} \)). Age showed a positive association with the level of PLI selectivity (no relation vs. age related to level: \( \chi^2[1] = 4.8, p < .05 \)), indicating that people started their trajectories on higher levels of selectivity with increasing age (standardized path coefficient = .19). No association between age and the slope of PLI selectivity was found (no relation vs. age related to slope: \( \chi^2[1] = 0.1, \text{ns} \)). Furthermore, age was negatively related to the level of optional PLI but unrelated to the slope of optional PLI (no relation vs. age related to level: \( \chi^2[1] = 5.4, p < .05 \), standardized path coefficient = -.17; no
relation vs. age related to slope: $\chi^2[1] = 0.1$, ns). Old-old persons thus started on lower levels of optional PLI compared to younger-old persons. Although no overall trend of increasing PLI selectivity or declining optional PLI was observed across the up to ten years in BASE, these analyses support the notion of some long-term change during old age in the direction of higher PLI selectivity and lower optional PLI. No long-term change in average PLI or obligatory PLI was evident.

**Longitudinal dynamics between obligatory and optional PLI.** In addition to change in individual PLI facets, associations between change in obligatory PLI and change in optional PLI are now studied. Hypothesis 2h predicted that change in obligatory PLI impacts on change in optional PLI but that change in optional PLI has only a small impact or no impact on change in obligatory PLI. In section G5, two bivariate LDS models have been presented that allow to test this hypothesis: The model shown in Figure 10 (p. 146) allows to estimate cross-lagged effects between changes in the two PLI facets and the model shown in Figure 11 (p. 147) allows to determine the direction of causality when only contemporaneous effects between changes in the two PLI facets are considered. As previously stated, the choice between those two models should be guided by theoretical considerations regarding the timing of the phenomenon under study relative to the timing of assessments (Hertzog & Nesselroade, 2003). The self-regulatory dynamics between obligatory PLI and optional PLI are expected to operate on relatively short time scales (considerably shorter than one year or even several years). Therefore, the estimation of simultaneous effects (Figure 11) is preferred to the estimation of lagged effects (Figure 10). Still, models with cross-lagged effects are estimated for comparison purposes.

The best-fitting univariate LDS models for obligatory PLI and optional PLI served as a basis for testing of longitudinal relationships. Note that the quadratic slope found for optional PLI was included in these analyses but was not depicted in Figure 11. However, as this slope has no variance, and hence cannot show any correlations, it is of little interest to the following analyses. In a first step, levels and slopes of obligatory PLI and optional PLI were estimated in one analysis but no associations between obligatory PLI and optional PLI of any kind were permitted (no correlations between levels and slopes, no coupling). This baseline model was first compared to models including correlations between the levels and slopes of obligatory PLI and optional PLI in order to determine which correlations are of potential interest. After that, coupling parameters were considered. The fit statistics for all estimated bivariate LDS models are given in Appendix C2. Here, I will report only the most central model comparisons.

Both adding a correlation between level of obligatory PLI and level of optional PLI, $r = .25$, $\chi^2(1) = 25.6$, $p < .001$, and adding a correlation between slope of obligatory and linear
slope of optional PLI, \( r = .68, \chi^2(1) = 17.9, p < .001 \), significantly improved the model fit. Including correlations between level of obligatory PLI and linear slope of optional PLI and between level of optional PLI and slope of obligatory PLI did not further improve the fit, \( \chi^2(2) = 0.7, p = .71 \). Thus, there were contemporaneous associations between initial levels and slopes of obligatory PLI and optional PLI. Given the positive correlation between slopes, it was possible to determine the direction of causality between change in obligatory PLI and change in optional PLI. The covariance between the two linear slope factors was set to zero and instead two \( \gamma \) paths were added (Figure 11): One from change in obligatory PLI at time [t] to change in optional PLI at time [t] and one from change in optional PLI at time [t] to change in obligatory PLI at time [t]. It was then tested whether it is possible to constrain one of the two paths to zero without losing fit. The model fitted worse once the path from change in obligatory PLI to change in optional PLI was set to zero, \( \chi^2(1) = 5.4, p < .05 \). In contrast, setting the path from change in obligatory PLI to change in optional PLI to zero did not change the model fit, \( \chi^2(1) = 0.3, ns \). Thus, change in obligatory PLI indeed had a dominant contemporaneous effect on change in optional PLI.

For comparison purposes, lead-lag relationships between change in obligatory PLI and change in optional PLI were also tested (the \( \gamma \) parameters in Figure 10). As can be seen in Appendix C2, inclusion of cross-lagged relationships in addition to contemporaneous effects does not improve the model fit. Thus, obligatory PLI and optional PLI showed concurrent relationships but no lead-lag relationships (as was to be expected due to large time intervals in BASE).

In sum, both levels and slopes of obligatory PLI and optional PLI were found to be positively correlated, indicating that the two PLI facets tended to change together. Moreover, hypothesis 2h was supported: Change in obligatory PLI had an impact on change in optional PLI (standardized \( \gamma \) path = .65) but change in optional PLI did not impact on change in obligatory PLI. This finding is illustrated in Figure 19, where the developmental trajectories estimated with the best-fitting bivariate LDS model for obligatory PLI and optional PLI of 50 exemplary participants are depicted. Several almost vertical trajectories indicate that there was much change in optional PLI that was not accompanied by change in obligatory PLI. In contrast, almost horizontal lines are clearly absent, showing that change in obligatory PLI was usually accompanied by change in optional PLI. Changes in both PLI facets tended to be in the same direction (i.e., in most cases both facets increased or both facets declined).
Joint development of obligatory PLI and optional PLI across time-in-study. Estimated trajectories for 50 participants are plotted. Dots indicate the starting point of each trajectory.

Latent Difference Score Models for PLI Facets Across Age

In contrast to LDS models across time-in-study, LDS models across age can provide information on changes in PLI across the entire age range between 70 and 100 years included in BASE. Moreover, specific change functions, such as a model positing change only during the eighties but stability during the seventies and nineties, can be estimated. This kind of model cannot be tested with a LDS model across time-in-study with age included as a covariate. The selection of LDS models that were fitted across age differed somewhat from the selection of LDS models across time-in-study. Models that clearly did not fit the PLI data in the previous LDS models (such as the proportional change score [PCS] model or dual change score [DCS] model) were not again tested. A new LDS model was included to test for stability during the seventh decade, change during the eighth decade, and again stability during the ninth decade of life \((\alpha[1] - \alpha[6] = 0, \alpha[7] - \alpha[11] = 0.2, \alpha[12] - \alpha[16] = 0)\). Theoretical considerations and empirical findings pointed to the possibility to observe this kind of change function in PLI (cf. p. 65, pp. 94 – 95). The new LDS model is compared to LDS models that specify linear or quadratic change across the 31 years covered in BASE.
LDS models across age in the longitudinal sample. Results for PLI selectivity and obligatory PLI were similar. For both PLI facets a no change score (NCS) model provided the best fit to the data (Table 13). Thus, there was some interindividual variability in characteristic levels of these two PLI facets but no change between 70 and 101 years was evident. Variability in slopes despite the slope mean being zero was not detected with LDS models for PLI selectivity and obligatory PLI across age. The average level of PLI selectivity was 26.3 and the average level of obligatory PLI was 60.6 (Table 14; Figure 20).

Table 13
Comparison of Different Latent Difference Score (LDS) Models for PLI Facets Across Age

<table>
<thead>
<tr>
<th>Model</th>
<th>Statistic</th>
<th>N Par.</th>
<th>A-2LL</th>
<th>AN Par.</th>
<th>p</th>
<th>AIC</th>
<th>BIC</th>
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<td>Average PLI</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
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<td>-2LL 4,644.9</td>
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<td></td>
<td></td>
<td></td>
<td>4,650.9</td>
<td>4,660.9</td>
</tr>
<tr>
<td>2: CCS without SD slope and r</td>
<td>4,644.2</td>
<td>4</td>
<td>vs. 1: 0.7</td>
<td>1</td>
<td>.40</td>
<td>4,652.2</td>
<td>4,665.5</td>
</tr>
<tr>
<td>3: CCS without r</td>
<td>4,640.3</td>
<td>5</td>
<td>vs. 1: 4.6</td>
<td>2</td>
<td>.10</td>
<td>4,650.3</td>
<td>4,666.9</td>
</tr>
<tr>
<td>4: QCS without rs</td>
<td>4,639.4</td>
<td>7</td>
<td>vs. 1: 5.5</td>
<td>4</td>
<td>.24</td>
<td>4,653.4</td>
<td>4,676.7</td>
</tr>
<tr>
<td>5: LDS: stable 70s, declining 80s,</td>
<td>4,638.2</td>
<td>5</td>
<td>vs. 1: 6.7</td>
<td>2</td>
<td>.04</td>
<td>4,648.2</td>
<td>4,664.8</td>
</tr>
<tr>
<td>stable 90s without r</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLI Selectivity</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
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<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3,958.1</td>
<td>3,968.1</td>
</tr>
<tr>
<td>2: CCS without r</td>
<td>3,951.5</td>
<td>5</td>
<td>vs. 1: 0.6</td>
<td>2</td>
<td>.74</td>
<td>3,961.5</td>
<td>3,978.1</td>
</tr>
<tr>
<td>3: QCS without SD QS and rs</td>
<td>3,951.2</td>
<td>6</td>
<td>vs. 1: 0.9</td>
<td>3</td>
<td>.83</td>
<td>3,963.2</td>
<td>3,983.2</td>
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<td>4: LDS: stable 70s, declining 80s,</td>
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<td>vs. 1: 0.3</td>
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<td>.58</td>
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<td>stable 90s without SD slope and r</td>
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<tr>
<td>Obligatory PLI</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>4,867.8</td>
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<td></td>
<td></td>
<td>4,873.8</td>
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<td>4,876.6</td>
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</tr>
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<td>vs. 1: 0.5</td>
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</tr>
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<tr>
<td>Optional PLI</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>1: NCS</td>
<td>5,021.3</td>
<td>3</td>
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<td></td>
<td></td>
<td>5,027.3</td>
<td>5,037.3</td>
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<tr>
<td>2: CCS without SD slope and r</td>
<td>5,015.4</td>
<td>4</td>
<td>vs. 1: 5.9</td>
<td>1</td>
<td>.02</td>
<td>5,023.4</td>
<td>5,036.8</td>
</tr>
<tr>
<td>3: CCS without r</td>
<td>5,012.9</td>
<td>5</td>
<td>vs. 2: 2.5</td>
<td>1</td>
<td>.11</td>
<td>5,022.9</td>
<td>5,039.5</td>
</tr>
<tr>
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<td>5,014.0</td>
<td>5</td>
<td>vs. 2: 1.4</td>
<td>1</td>
<td>.24</td>
<td>5,024.0</td>
<td>5,040.7</td>
</tr>
<tr>
<td>5: LDS: stable 70s, declining 80s,</td>
<td>5,015.4</td>
<td>4</td>
<td>vs. 2: 0.0</td>
<td>0</td>
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<td>5,023.4</td>
<td>5,036.7</td>
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<tr>
<td>stable 90s without SD slope and r</td>
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<td></td>
</tr>
<tr>
<td>6: LDS: stable 70s, declining 80s,</td>
<td>5,008.2</td>
<td>5</td>
<td>vs. 2: 7.2</td>
<td>1</td>
<td>.01</td>
<td>5,018.2</td>
<td>5,034.8</td>
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<td>stable 90s without r</td>
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</tbody>
</table>

Note. Best-fitting models are printed in italics. NCS = No Change Score; CCS = Constant Change Score; QCS = Quadratic Change Score; LDS = Latent Difference Score; -2LL = -2 × log-likelihood of model; N Par. = Number of Parameters; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.
The added LDS model positing stability, change, and again stability demonstrated the best fit with average PLI. Here, the mean trajectory was at a level of 54.9 during the seventies, declined by 1.9 POMP units during the eighties, and stabilized at 53.0 during the nineties. As with the LDS model across time-in-study, mean level change in average PLI was again not different from zero, 95% CI (-4.8; 1.0), but there was some variability in trajectories of average PLI during the eighties. This variability was not detected with a CCS model positing a linear decline in average PLI between age 70 and 101. Variability in slopes hence seemed to be highest between 80 and 90 years, that is, during the beginning of the fourth age for the majority of participants.

Table 14
Parameter Estimates for Best-Fitting LDS Models Across Age

<table>
<thead>
<tr>
<th>PLI Facet</th>
<th>M Level (SD)</th>
<th>M Linear Slope (SD)</th>
<th>SD Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average PLI</td>
<td>54.9 (9.0)</td>
<td>-1.9 (7.2)</td>
<td>7.8</td>
</tr>
<tr>
<td>PLI Selectivity</td>
<td>26.3 (5.0)</td>
<td>---</td>
<td>5.2</td>
</tr>
<tr>
<td>Obligatory PLI</td>
<td>60.6 (11.3)</td>
<td>---</td>
<td>9.6</td>
</tr>
<tr>
<td>Optional PLI</td>
<td>46.6 (11.1)</td>
<td>-4.3 (10.6)</td>
<td>10.7</td>
</tr>
</tbody>
</table>

Note: Dashed lines indicate parameters that have not been estimated.

The stability-change-stability LDS model also yielded the best fit with optional PLI. If only the average linear slope was considered but not the variance in slopes, the CCS model and the LDS model did not significantly differ from each other (Table 13). However, once variability in slopes was included, no variability was found with the CCS model. The stability-change-stability LDS model, in contrast, indicated a significant amount of variability in change during the eighties (Table 13). Furthermore, the linear decline of 4.3 POMP units in optional PLI between 80 and 90 years differed from zero, 95% CI (-8.2; -0.4). All parameter estimates from the best-fitting models across age are reported in Table 14. The resulting estimated mean trajectories are presented in Figure 20 (left panel).

When one compares the best-fitting models that have been identified for the four PLI facets across time-in-study and across age, the findings are usually similar. Mean trajectories of average PLI, PLI selectivity, and obligatory PLI did not show significant change either across time-in-study or age-at-measurement. In contrast, the findings of declining optional PLI across age and quadratic change in optional PLI across time-in-study may seem to contradict each other. Thus, the estimated individual trajectories from the best-fitting LDS models across age-at-measurement and time-in-study for optional PLI were depicted as a function of age in Figure 21 to allow for a visual inspection of differences and similarities between the models. First, it can be seen that more interindividual variability in change was retained with the model across time-in-study (lower panel). Variability in change was not only evident during the eighties but also before
age 80 and after age 90. As the optional PLI assessments were stretched out across many more time points in the LDS model across age (16 compared to 6 in the model across time-in-study), fewer data were available to model each part of the trajectory and it thus became more difficult (or impossible) to demonstrate interindividual variability in change. Second, it is illustrated that the quadratic slope that was found with the model across time-in-study helps to model accelerating or decelerating increase or decline in optional PLI in many participants. Still, those people, overall, showed declining or increasing trajectories. Those participants who showed a decline that was followed by an increase usually ended up at the same level they had initially reported. Third, the overall picture that emerged when change was modeled across time-in-study, by and large, suggests the same change function that was found when change was modeled across age: There is not much average level change during the seventies, decline is evident during the eighties, and during the nineties there is again not much average level change. This general picture is also supported by the reported association between age and initial levels of optional PLI in the LDS model across time-in-study: Older participants started their trajectories on lower levels. In sum, the LDS models across time-in-study and age-at-measurement for optional PLI do not contradict each other. The LDS model across time-in-study was more sensitive to interindividual differences in the direction of change and to interindividual differences in change functions. Still, the overall picture of age-related change in PLI is pretty much the same. The greatest amount of variability in change in optional PLI and a declining tendency of optional PLI during the eighties can also be detected in the trajectories that were estimated across time-in-study.

![Figure 20](image_url). Development of PLI facets across age. The estimated average trajectories for the longitudinal and cross-sectional samples are plotted.
Figure 21. Comparison of estimated individual trajectories for optional PLI across age from the LDS model across age (upper panel) and from the LDS model across time-in-study (lower panel).

Comparison of longitudinal and cross-sectional age trajectories. Based on the best-fitting models across age, the average age trajectories in the longitudinal sample ($N = 206,619$ PLI assessments) are now compared to the average age trajectories in the cross-sectional sample ($N = 511,511$ PLI assessments). Do the longitudinal data suggest the same developmental trajectory as the cross-
sectional data? This comparison is required to test hypothesis 2c, which stated that less developmental change in optional PLI is observed in the longitudinal sample compared to the cross-sectional sample, but that the estimated trajectories for obligatory PLI do not differ when comparing the cross-sectional sample and the longitudinal sample.

It is possible to compare the level and slope parameters that have been obtained with the longitudinal sample to the level and slope that are observed with the cross-sectional data (e.g., Singer, Verhaeghen et al., 2003). If the variances of the level and slope factors are constrained to zero, that is, if no individual trajectories but just one average trajectory for the entire sample is estimated, it is possible to compute LDS models with only cross-sectional data. Then, two models can be compared: One unconstrained model that estimates the level and slope parameters with the cross-sectional data and one model in which parameters in the cross-sectional sample are constrained equal to parameters obtained with the longitudinal sample. Depending on the question at hand, the level and/or slope can be constrained. If the two models show a significant difference in fit, the cross-sectional and longitudinal data do not suggest identical developmental trajectories.

First a LDS model with no variability in level and slope was specified for the cross-sectional data and the mean level and slope were estimated. In a second step, the mean level was set equal to the mean level that had been obtained with the longitudinal sample. For PLI selectivity, this constraint led to a significant loss of fit, $\chi^2(1) = 19.1, p < .001$. The mean level of selectivity in the cross-sectional sample was estimated as 27.8 and thus was significantly higher than the level of 26.3 in the longitudinal sample. The levels of average PLI, obligatory PLI, and optional PLI did not differ between the cross-sectional sample and longitudinal sample (average PLI: $\chi^2[1] = 0.3, ns$; obligatory PLI: $\chi^2[1] = 0.2, ns$; optional PLI: $\chi^2[1] = 0.0, ns$). In a third step, the slope was set equal to the slope estimated in the longitudinal sample. The slopes of average PLI and optional PLI were found to significantly differ between the cross-sectional sample and the longitudinal sample (average PLI: $\chi^2[1] = 8.1, p < .001$; optional PLI: $\chi^2[1] = 16.1, p < .001$): Slopes were steeper in the cross-sectional sample. Average PLI demonstrated a decline of 4.5 POMP units between 80 – 81 and 90 – 91 years that was larger than the loss of 1.9 POMP units in the longitudinal sample. Similarly, the decline in optional PLI was greater in the cross-sectional sample ($M_{\text{Slope}} = -9.0$) compared to the longitudinal sample ($M_{\text{Slope}} = -4.3$). The differences between the estimated trajectories of the longitudinal and cross-sectional samples are illustrated in Figure 20. In line with hypothesis 2c, obligatory PLI is the only PLI facet for which no differences between the two samples were found. PLI selectivity was on a higher level in the cross-sectional sample. Average PLI and optional PLI started on the same level during the seventies but showed steeper declines during the eighties and, hence, lower levels during the nineties in
the cross-sectional sample. Thus, as predicted, optional PLI demonstrated less change in the longitudinal sample, speaking again to a somewhat positive selection among participants with regard to optional PLI.

**Summary: Development of PLI and Dynamics between Obligatory PLI and Optional PLI**

Overall, selectivity analyses with regard to mean levels and variances and covariances demonstrated only negligible selectivity effects for PLI in the T3 and T5 samples. When selectivity in the T3 sample was estimated separately for participants in their seventies, eighties, and nineties, no indications of selective survival or sampling were found with participants under 90 years. However, small total selectivity effects were obtained for mean PLI selectivity and mean optional PLI with participants aged 90 and older. The oldest-old participants in the longitudinal sample thus represent a somewhat positive selection among the nonagenarians. Small total selectivity effects for PLI selectivity (lower) and optional PLI (higher) were found in the T5 sample, which largely vanished after controlling for age. Hypothesis 2a, predicting some mortality-associated selectivity in optional PLI but no mortality-associated selectivity in obligatory PLI and a reduction of mortality-associated selectivity in optional PLI after controlling for age, was supported. Although selectivity effects were generally small, optional PLI demonstrated the largest mortality-associated selectivity effect and obligatory PLI showed no mortality-associated selectivity. Mortality-associated selectivity for optional PLI was considerably reduced after controlling for age.

Rank-order stabilities of the four PLI facets were moderate and generally did not differ between age groups. Stability estimates for PLI selectivity were the exception from this general pattern. Rank-order stability of PLI selectivity was moderate in participants under 90 years but zero in participants aged 90 and older. Hypothesis 2b positing a differential impact of larger time intervals between measurements on stability estimates for obligatory PLI and optional PLI was supported: Rank-order stabilities of optional PLI clearly declined with increasing time intervals between measurements, while rank-order stabilities of obligatory PLI were not systematically affected by time interval.

Hypotheses 2d – 2g formulated the expected developmental trends of the four PLI facets both across time-in-study and across age. It was predicted that average PLI, PLI selectivity, and obligatory PLI remain unchanged and optional PLI declines when modeled across time-in-study. When modeled across the entire age range in BASE, average PLI and optional PLI were expected to decline, PLI selectivity was expected to increase, and no change was predicted for obligatory PLI. In sum, the LDS models across time-in-study showed that, on an average level, no PLI facet demonstrated significant change across the ten-year time interval in BASE. This finding is in line with the cross-sectional sample.
with hypotheses 2d, 2e, and 2f predicting no change in average PLI, PLI selectivity, and obligatory PLI, respectively. Contrary to the hypothesized pattern (2g), optional PLI, on average, showed a quadratic rather than a declining trend. The initial declining tendency was offset by a following slight increase. This trend should be interpreted in light of the finding that optional PLI did not decline at all ages but rather showed decline mainly during the eighth decade of life and in light of the small selectivity effects that have been reported for optional PLI. Participants in the longitudinal sample were younger and reported slightly higher optional PLI compared to the entire cross-sectional sample. Averaging across the participants in the longitudinal sample thus did not suggest an overall declining trajectory of optional PLI. Still, there was interindividual variability in change, showing that several participants actually did reduce optional PLI, while others did not change optional PLI or even increased optional PLI. The association between higher age and lower initial levels of optional PLI nevertheless supports the assumption that optional PLI tends to decline during old age, even if not at all ages and in all people. Similar to optional PLI, interindividual variability in change patterns was also found for the other three PLI facets. Declining, stable, and increasing trajectories were observed for average PLI, PLI selectivity, and obligatory PLI.

In addition to determining trajectories of individual PLI facets, developmental changes in obligatory PLI and optional PLI across time-in-study were also linked. Hypothesis 2h maintained that change in obligatory PLI has a dominant impact on change in optional PLI. Employing a bivariate LDS model that included only contemporaneous associations between changes of the two variables supported this hypothesis: Change in obligatory PLI was found to impact on change in optional PLI, but change in optional PLI had no impact on change in obligatory PLI. This pattern was not evident once lead-lag relationships between change in obligatory PLI and change in optional PLI were considered. No cross-lagged associations between the two PLI facets were found, which is most likely due to the relatively large time intervals in BASE that preclude to observe self-regulatory dynamics across time points.

The overall picture of change in optional PLI across age was stability prior to age 80, decline between 80 – 81 and 90 – 91 years, and stability after 91 years, which supports hypothesis 2g. A similar but insignificant decline was observed for average PLI. That is, the hypothesized small decline in average PLI (hypothesis 2d) was not evident in the longitudinal sample. Change in optional PLI and average PLI across age was more pronounced when the cross-sectional data were investigated, which again points to selectivity especially among the oldest-old participants in the longitudinal sample. Here, average PLI was found to decline between 80 – 81 and 90 – 91 years. There was no indication of change in mean levels of PLI selectivity and obligatory PLI across age. Thus, the predicted slight increase in PLI selectivity across age (hypothesis 2e) was
The last major research question concerns the role of personal life investment for successful aging. Here, the initial levels of and changes in the four PLI facets, functional health, and life satisfaction and aging satisfaction are related to each other. The previously employed bivariate LDS models could be extended to multivariate LDS models that include three or more variables. For one major reason, this approach was not taken to investigate the role of PLI for successful aging: Multivariate LDS models similar to the bivariate LDS models depicted in Figures 10 and 11 do not capture the hypothesized interactive effects of PLI and functional health on satisfaction. Moreover, a multivariate model simultaneously including change in four variables and the dynamic interplay between all four variables might be hard to fit.

Thus, an alternative strategy was employed here. LDS models were first computed separately for all variables of interest (i.e., the four PLI facets, functional health, life satisfaction, aging satisfaction) and the best-fitting models were determined. Where T2 data had been assessed they were included in the analyses. As T5 data on functional health, life satisfaction, and aging satisfaction are not available in this study, the analyses were constrained to T1 to T4 data for all variables. This means that the best-fitting models for average PLI, PLI selectivity, obligatory PLI, and optional PLI again were identified, this time based on only two or three PLI assessments per participant. That way, it can be ensured that the considered independent variables were not assessed after the dependent variables life satisfaction and aging satisfaction. The estimated level and slope parameters for each participant are used as variables in hierarchical linear regressions.

This approach has three advantages. First, the levels and slopes estimated with the LDS models are less influenced by measurement error and change-independent variance than raw score differences or residualized change scores that could be computed with the T1 and T4 data. Second, the estimated slopes have accounted for different time intervals between measurements. For each participant, the slope expresses expected change across seven to eight years (the maximum time interval between T1 and T4). Third, levels and slopes are computed for all 206 participants of the longitudinal study, which means that no one is excluded from the analyses.
regression analyses were performed with raw T1 and T4 data, this would lead to a substantial loss of participants and relevant information.

In the following, initial levels are related to each other in a first set of regression analyses. The initial level of life satisfaction or, respectively, aging satisfaction is predicted from the level of one of the four PLI facets, the level of functional health, and the interaction between the level of the respective PLI facet and the level of functional health. In a second step, satisfaction slopes are used as the dependent variables, that is, change in satisfaction is predicted. First, the initial levels of satisfaction, functional health, and PLI are entered in the regression to control for the impact of initial scores of these variables on change in satisfaction. It is then tested whether change in functional health and change in PLI can account for an additional portion of variance in satisfaction slopes. In a last step, the interaction between health slope and PLI slope is entered. The results of these analyses can provide interesting information on patterns of correlated change among PLI facets, health, and satisfaction. However, it needs to be stressed that these analyses do not tell us anything about lagged relationships as expressed through the coupling parameters $\gamma$ in a bivariate LDS model (Figure 10). That is, we cannot draw conclusions on causal influences between variables.

Description of variables involved in successful aging analyses. As stated above, the best-fitting LDS models across time-in-study between T1 and T4 for the four PLI facets, functional health, life satisfaction, and aging satisfaction were (again) determined. Here, models for the PLI facets were based on a maximum of three measurement occasions and models for health and satisfaction were based on a maximum of four measurement occasions (in contrast to PLI, these variables have been assessed at T2). Results of model comparisons are reported in Appendix D1. The omission of T5 data leads to a reduction in the complexity of the best-fitting LDS models for all PLI facets. Specifically, a NCS model now provides the best fit to average PLI and obligatory PLI data. The two PLI facets do not demonstrate significant mean level change or variability in change across the eight-year time interval between T1 and T4. PLI selectivity and optional PLI are best described by a CCS model, indicating a slight linear decline in PLI selectivity, 95% CI (-3.2; -0.3), and in optional PLI, 95% CI (-6.1; -0.0), with some variability in change patterns. CCS models also best describe change in functional health, life satisfaction, and aging satisfaction (cf. Appendix D1). All three variables show some linear decline and also some variability in change patterns.

The best-fitting LDS models for each variable served as a basis to compute an estimated initial level and slope for each of the 206 participants in the longitudinal sample. Specifically, a characteristic and unchanging level of average PLI and obligatory PLI across the 8-year time
interval, the estimated level at T1 for PLI selectivity, optional PLI, functional health, life satisfaction, and aging satisfaction, and a slope indicating the amount of linear change across eight years in PLI selectivity, optional PLI, functional health, life satisfaction, and aging satisfaction were estimated for each participant and output to a data file. The resulting variables are described in Table 15. The estimated mean levels of the four PLI facets were identical to the levels that had been obtained with the T1 to T5 LDS models across time-in-study. On average, PLI selectivity declined by 1.8 and optional PLI declined by 3.0 POMP units across eight years. Considering the standard deviations of the initial levels, this means that PLI selectivity declined about half a standard deviation and optional PLI declined about 0.3 \( SD \) units across eight years. Functional health also demonstrated a small decline of 2.9 t-score units, that is, about 0.6 \( SD \) units in eight years. The average decline in satisfaction was somewhat larger: Both life satisfaction and aging satisfaction declined by 12.2 POMP units, which amounts to about one standard deviation in eight years. However, as evident in the range of slope values, decline was not typical of all BASE participants. Rather, declining, stable, and also increasing trajectories were present.

### Table 15

<table>
<thead>
<tr>
<th></th>
<th>Average PLI</th>
<th>Selectivity</th>
<th>Obligatory PLI</th>
<th>Optional PLI</th>
<th>Functional Health</th>
<th>Life Satisfaction</th>
<th>Aging Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level</strong></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>30.3 – 74.3</td>
<td>17.7 – 37.6</td>
<td>37.8 – 86.8</td>
<td>16.1 – 74.5</td>
<td>42.1 – 64.3</td>
<td>38.1 – 94.5</td>
<td>28.3 – 94.3</td>
</tr>
<tr>
<td><strong>Linear Slope</strong></td>
<td>-8.3 – 2.6</td>
<td>-3.0 (6.7)</td>
<td>-2.9 (2.0)</td>
<td>-12.2 (8.2)</td>
<td>-12.2 (7.7)</td>
<td>-34.3 – 8.4</td>
<td>-33.1 – 9.1</td>
</tr>
</tbody>
</table>

*Note: Dashed lines indicate parameters that have not been estimated.*

Table 16 reports the intercorrelations of all variables. It was assumed that optional PLI and average PLI are positively related, PLI selectivity is negatively related, and obligatory PLI is unrelated to functional health (hypothesis 3a). This hypothesis is supported by the reported variable intercorrelations between levels: The level of functional health at T1 was positively correlated with the characteristic level of average PLI, \( r = .17 \), and the level of optional PLI at T1, \( r = .34 \), negatively correlated with T1 level of PLI selectivity, \( r = -.27 \), and unrelated to the characteristic level of obligatory PLI, \( r = .01 \). However, these associations were not evident when changes in the respective variables were considered. Neither the slope of optional PLI, \( r = .02 \), nor the slope of PLI selectivity, \( r = -.10 \), were related to the functional health slope. The smaller slope variances compared to the level variances (Table 15) may lead to attenuated correlations and hence make it difficult to demonstrate associations between change in PLI and change in health.
Table 16  
**Intercorrelations of Variables Involved in Successful Aging Analyses (N = 205 – 206)**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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</thead>
<tbody>
<tr>
<td><strong>Average PLI</strong></td>
<td>1 L</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PLI</strong></td>
<td>2 L</td>
<td>-.22**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selectivity</td>
<td>3 S</td>
<td>-.06</td>
<td>.53***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Obligatory PLI</strong></td>
<td>4 L</td>
<td>.87***</td>
<td>-.02</td>
<td>.09</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Optional PLI</strong></td>
<td>5 L</td>
<td>.68***</td>
<td>-.36***</td>
<td>-.19***</td>
<td>.25***</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Functional Health</strong></td>
<td>6 S</td>
<td>.04</td>
<td>.02</td>
<td>-.15*</td>
<td>.09</td>
<td>-.36***</td>
<td>-.19**</td>
<td>.25***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Life Satisfaction</strong></td>
<td>7 L</td>
<td>.17*</td>
<td>-.27***</td>
<td>-.09</td>
<td>.01</td>
<td>.34***</td>
<td>-.17*</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Aging Satisfaction</strong></td>
<td>8 S</td>
<td>.09</td>
<td>-.18**</td>
<td>-.10</td>
<td>.01</td>
<td>.13</td>
<td>.02</td>
<td>.24***</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Age at T1</strong></td>
<td>9 L</td>
<td>.14</td>
<td>-.18*</td>
<td>.01</td>
<td>.01</td>
<td>.27***</td>
<td>-.17*</td>
<td>.42***</td>
<td>.17*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>10 S</td>
<td>-.05</td>
<td>-.06</td>
<td>.11</td>
<td>-.04</td>
<td>-.01</td>
<td>-.06</td>
<td>.13</td>
<td>.22**</td>
<td>.37***</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aging</strong></td>
<td>11 L</td>
<td>.19**</td>
<td>-.25***</td>
<td>-.07</td>
<td>-.01</td>
<td>.41***</td>
<td>-.16*</td>
<td>.52***</td>
<td>.21**</td>
<td>.71***</td>
<td>.23**</td>
<td></td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>12 S</td>
<td>-.15*</td>
<td>.01</td>
<td>-.04</td>
<td>-.12</td>
<td>-.12</td>
<td>.04</td>
<td>-.01</td>
<td>.18**</td>
<td>-.20**</td>
<td>.25***</td>
<td>-.42***</td>
</tr>
<tr>
<td><strong>Age at T1</strong></td>
<td>13</td>
<td>-.11</td>
<td>.16*</td>
<td>.02</td>
<td>-.03</td>
<td>-.19**</td>
<td>.10</td>
<td>-.65***</td>
<td>-.31***</td>
<td>-.26***</td>
<td>-.16*</td>
<td>-.26***</td>
</tr>
</tbody>
</table>

*Note. L = Level; S = Slope.  
*p < .05. **p < .01. ***p < .001.

Age at T1 has been included in Table 16 as a potentially interesting control variable to be considered in the analyses. The correlational pattern between age and PLI facets is in accordance with the reported findings from the LDS models across time-in-study (including T5). Age was positively related to the initial level of PLI selectivity, $r = .16$, and negatively related to the level of optional PLI, $r = -.19$. Age was unrelated to the remaining levels and slopes of PLI facets. In addition, age was negatively correlated with the level, $r = -.65$, and slope, $r = -.31$, of functional health: Older-old people were less healthy at the beginning of the study and also experienced greater losses in functional health compared to younger-old people. Similarly, higher age was linked to lower initial levels of life satisfaction, $r = -.26$, and aging satisfaction, $r = -.26$, and a steeper decline in life satisfaction, $r = -.16$.

**Testing for moderating effects of levels of PLI facets on the association between level of health and level of satisfaction.** As mentioned, two sets of regression analyses were conducted. First, the moderating function of PLI facets was determined cross-sectionally. Second, moderating effects on change in satisfaction were examined. Level of life satisfaction and level of aging satisfaction at T1 were used as the dependent variables in hierarchical multiple regressions. In a first step, the level of functional health and the level of PLI were entered in the regression. Here, separate analyses were conducted with level of average PLI and level of PLI selectivity as independent variables. In contrast, level of obligatory PLI and level of optional PLI were combined in one analysis, as a moderating role of obligatory PLI on the relationship between optional PLI and satisfaction has
been predicted (hypothesis 3g) in addition to a moderating role of optional PLI on the relationship between health and satisfaction (hypothesis 3e). The first step in the regressions helps to determine whether average PLI, PLI selectivity or, respectively, obligatory PLI and optional PLI can contribute to the prediction of satisfaction once the association between health and satisfaction is taken into account. In a second step, interaction terms relevant to hypothesis testing were introduced to the regressions.

Table 17 summarizes the results of the regression analyses. PLI facets have been hypothesized to have both a direct effect on satisfaction and also to moderate the relationship between functional health and satisfaction. Specifically, it was predicted that optional PLI and average PLI are positively related, PLI selectivity is negatively related, and obligatory PLI is

Table 17
Hierarchical Multiple Regression Analyses: Direct and Moderating Effects of Levels of PLI Facets and Functional Health on Levels of Satisfaction (N = 205 – 206)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Steps 1 Life Satisfaction</th>
<th>Steps 2 Aging Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 β</td>
<td>1 B</td>
</tr>
<tr>
<td><strong>Average PLI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 L functional health (LFH)</td>
<td>.40***</td>
<td>1.09***</td>
</tr>
<tr>
<td>L average PLI (LAP)</td>
<td>.07</td>
<td>0.10</td>
</tr>
<tr>
<td>2 LFH × LAP</td>
<td>.15*</td>
<td>1.79*</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.18***</td>
<td>.02*</td>
</tr>
<tr>
<td>R²</td>
<td>.18***</td>
<td>.20***</td>
</tr>
<tr>
<td><strong>PLI Selectivity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 L functional health (LFH)</td>
<td>.40***</td>
<td>1.07***</td>
</tr>
<tr>
<td>L PLI selectivity (LPS)</td>
<td>-.07</td>
<td>-.24</td>
</tr>
<tr>
<td>2 LFH × LPS</td>
<td>-.05</td>
<td>-.07</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.18***</td>
<td>.00</td>
</tr>
<tr>
<td>R²</td>
<td>.18***</td>
<td>.18***</td>
</tr>
<tr>
<td><strong>Obligatory PLI and Optional PLI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 L functional health (LFH)</td>
<td>.36***</td>
<td>.98***</td>
</tr>
<tr>
<td>L obligatory PLI (LOB)</td>
<td>-.03</td>
<td>-.04</td>
</tr>
<tr>
<td>L optional PLI (LOP)</td>
<td>.15*</td>
<td>.17*</td>
</tr>
<tr>
<td>2 LFH × LOB</td>
<td>-.01</td>
<td>-.09</td>
</tr>
<tr>
<td>LFH × LOB</td>
<td>.15*</td>
<td>.17*</td>
</tr>
<tr>
<td>1OB × LOP</td>
<td>.15*</td>
<td>.17*</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.19***</td>
<td>.05**</td>
</tr>
<tr>
<td>R²</td>
<td>.19***</td>
<td>.24***</td>
</tr>
</tbody>
</table>

Note. All tolerances are above .80. L = Level.
*p < .10. *p < .05. **p < .01. ***p < .001.

15 Variables were z-standardized before computing interaction terms to obtain interpretable beta weights (cf. Cohen et al., 2003).
16 All analyses were rerun with age at T1 included as a control variable. As age, however, did not obtain a significant beta weight in any of the regressions and the inclusion of age did not alter any of the results, these analyses are not reported.
unrelated to life satisfaction and aging satisfaction (hypothesis 3b). Moreover, average PLI, PLI selectivity, and optional PLI, but not obligatory PLI, were expected to moderate the relationship between health and satisfaction (hypotheses 3c – 3f). As can be seen in the left panel of Table 17, neither the level of PLI selectivity nor the level of average PLI were related to life satisfaction once the level of functional health was considered. Thus, the reported correlations of level of life satisfaction with level of PLI selectivity, $r = -.18$ (Table 16), and level of average PLI, $r = .14$, $p = .05$, are not robust against controlling for functional health level. Associations between level of average PLI or level of PLI selectivity and level of aging satisfaction remained marginally significant after functional health level had been considered. In line with hypothesis 3b, the level of optional PLI was positively related to both the level of life satisfaction and the level of aging satisfaction even after controlling for functional health level (Table 17). The characteristic level of obligatory PLI was unrelated to level of life satisfaction and level of aging satisfaction in all analyses (Tables 16 and 17).

As to the moderating role of PLI, a significant interaction between the T1 level of functional health and the characteristic level of average PLI emerged in the analysis with level of life satisfaction as the dependent variable. This interaction explained 2% of additional variance (Table 17, left panel). A parallel finding was obtained with aging satisfaction as the dependent variable. Again, a significant interaction between level of functional health and level of average PLI was obtained, which accounted for 3% of additional variance (Table 17, right panel).

Panel A of Figure 22 illustrates the moderating role of average PLI level on the association between level of functional health and level of satisfaction. For this illustration, three groups of participants were formed: People with average PLI levels more than one standard deviation below the mean (“low”), people with average PLI levels within the range of ±1 SD (“average”), and people with average PLI levels more than one standard deviation above the mean (“high”). The previously demonstrated interaction between health and average PLI in predicting satisfaction (Staudinger & Fleeson, 1996; Staudinger et al., 1999) was replicated with the longitudinal sample: The association between functional health and life satisfaction or aging satisfaction became smaller at lower levels of average PLI. That is, low average PLI helped to buffer the negative impact of poor functional health on satisfaction. In contrast, high average investment was functional to achieve high levels of satisfaction for those people in relatively good health. Please note that this replication is not trivial, as the health variable in this study was based in part on different indicators and the sample size was considerably reduced compared to the cross-sectional BASE sample employed by Staudinger and collaborators.
Hypothesis 3d, predicting a moderating role of PLI selectivity on the relationship between health and satisfaction was not supported. No significant interaction between level of PLI selectivity and level of functional health was found with level of life satisfaction as the dependent variable, and with level of aging satisfaction as the dependent variable, the respective interaction was only marginally significant (Table 17). Following up on the marginally significant interaction between PLI selectivity and health in predicting aging satisfaction reveals that higher correlations between level of health and level of satisfaction are obtained at higher levels of PLI selectivity. For those participants with PLI selectivity more than one standard deviation below the mean, the correlation was $r = .09$, $p = .61$, $n = 33$. Positive correlations emerged for participants within the range of $\pm 1\ SD$, $r = .55$, $p < .001$, $n = 137$, and more than one standard deviation above the mean, $r = .53$, $p < .01$, $n = 35$. As PLI selectivity, that is, the intraindividual...
variability across the ten PLI domains, is by necessity low at the lowest levels of average PLI, this finding matches with the previous finding. Nevertheless, it shows that high PLI selectivity (which can occur at moderate levels of average PLI) did not help to buffer the impact of poor health on satisfaction. That is, reducing PLI across all life domains rather than maintaining high investment in some domains, while stopping to invest in other domains, seems to be most functional for those in very poor health.

The regressions including the characteristic level of obligatory PLI and the T1 level of optional PLI shed more light on which kinds of investment help to buffer the negative impact of poor health on satisfaction. When level of life satisfaction was used as the dependent variable, level of optional PLI interacted with level of functional health (Table 17, left panel). This interaction is also depicted in Figure 22 (panel B). Again, correlations between level of health and level of satisfaction were smaller at lower levels of optional PLI. In fact, health and life satisfaction were unrelated in those participants who had reported optional PLI levels of more than one standard deviation below the sample mean. Thus, older adults were most satisfied when in relatively good health and highly invested in optional PLI domains and least satisfied when in very bad health and still highly invested in optional PLI domains. Following up on the results that have been obtained with level of average PLI as independent variable, this means that it is in particular the maintenance of high levels of optional PLI that is dysfunctional for people in very poor health. A parallel interactive effect of optional PLI level and health level on aging satisfaction was not obtained in the analysis that included both optional PLI and obligatory PLI as independent variables (Table 17, right panel). However, it should be noted that when only optional PLI is considered, that is, when the regression analysis is conducted parallel to the reported analysis involving average PLI, the interaction between optional PLI level and health level explains a marginally significant 1% of additional variance, $F(1, 202) = 2.98, p = .09, \beta = .10$. For that reason, the moderating function of level of optional PLI with regard to the relationship between functional health level and level of aging satisfaction was also included in Figure 22 (panel B). Although the pattern of associations is again in line with the previously reported results, it should be kept in mind that this interactive effect is very small and at most marginally significant. Thus, hypothesis 3e on the moderating function of optional PLI is largely, but not completely, supported. As predicted in hypothesis 3f, obligatory PLI did not moderate the relationship between functional health level and level of life satisfaction or aging satisfaction.

Finally, hypothesis 3g maintained that the level of optional PLI is more strongly related to the level of satisfaction on high rather than low levels of obligatory PLI. The respective interaction between level of obligatory PLI and level of optional PLI was significant in both regressions (Table 17). Following up on the two interactions shows that the positive correlation
between level of optional PLI and level of satisfaction became bigger with increasing levels of obligatory PLI (Figure 23). Being highly invested in obligatory PLI domains (> $M + 1\ SD$) contributed to the highest levels of satisfaction when level of optional PLI was simultaneously high but to the lowest levels of satisfaction when level of optional PLI was simultaneously low. Being focused on obligatory PLI domains while completely neglecting optional PLI domains thus appears to be dysfunctional in old age. When obligatory PLI was very low, level of optional PLI showed only small associations with level of life satisfaction or aging satisfaction. That is, once obligatory PLI was very low, optional PLI was of less relevance to satisfaction.

Figure 23. The positive association between optional PLI and life satisfaction or aging satisfaction is smaller at lower levels of obligatory PLI.

Testing for moderating effects of change in PLI facets on the relation between change in health and change in satisfaction. In a final set of analyses, the longitudinal information on change in satisfaction, functional health, and PLI was examined. Here, only two PLI facets were considered: PLI selectivity and optional PLI. As average PLI and obligatory PLI did not show significant change or interindividual variability in change, the hypotheses regarding associations between change in these variables and change in health or satisfaction cannot be addressed and hence need to be rejected.

The slopes of life satisfaction or, respectively, aging satisfaction were employed as the dependent variables in the regression analyses. Initial levels of satisfaction, health, and PLI were included in the regressions to account for associations between initial levels and change. In a second step, the slope of functional health and the slope of PLI selectivity or the slope of op-
tional PLI were entered in the analyses. In step 3, the interaction between health slope and PLI slope was included. The results of the four conducted regression analyses are presented in Table 18. Across all analyses, only the first and second step explained a significant amount of variance in change in satisfaction. Initial levels of life satisfaction and aging satisfaction were related to change in life satisfaction and aging satisfaction. Moreover, the initial level of functional health was related to change in aging satisfaction but unrelated to change in life satisfaction (Table 18). Participants who were in better functional health at T1 reported less decline in aging satisfaction. Although the inclusion of functional health slopes and PLI slopes explained a significant 3% – 6% of additional variance in satisfaction slopes, it was usually change in health that was related to change in satisfaction: Those who experienced greater health losses also declined more on satisfaction. Change in PLI made a significant contribution to the prediction of change in satisfaction in only one analysis: The slope of PLI selectivity was related to the slope of life satisfaction. Reduction of PLI selectivity by one POMP unit was associated with a 0.76 POMP unit reduction in life satisfaction. The zero-order correlation of $r = .11$, ns (Table 16) between the two slopes had already pointed in this direction. However, a significant association only emerged when the impact of functional health on satisfaction was simultaneously considered. Interaction terms between health slopes and PLI slopes did not further add to the prediction (Table 18).

Table 18
Hierarchical Multiple Regression Analyses: Direct and Moderating Effects of Levels of and Changes in PLI Facets and Functional Health on Change in Satisfaction (N = 205 – 206)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Steps S Life Satisfaction</th>
<th>Steps S Aging Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 β</td>
<td>2 β</td>
</tr>
<tr>
<td>PLI Selectivity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 L satisfaction</td>
<td>.39***</td>
<td>.36***</td>
</tr>
<tr>
<td>L. functional health</td>
<td>0.00</td>
<td>0.06</td>
</tr>
<tr>
<td>L. PLI selectivity</td>
<td>0.00</td>
<td>0.06</td>
</tr>
<tr>
<td>2 S functional health (SFH)</td>
<td>.18**</td>
<td>.74**</td>
</tr>
<tr>
<td>S PLI selectivity (SPS)</td>
<td>.16*</td>
<td>.76*</td>
</tr>
<tr>
<td>3 SFH × SPS</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>∆R²</td>
<td>.15***</td>
<td>.05*</td>
</tr>
<tr>
<td>R²</td>
<td>.15***</td>
<td>.19***</td>
</tr>
</tbody>
</table>

| Optional PLI                |     |     |     |     |     |     |
|-----------------------------|     |     |     |     |     |     |
| 1 L satisfaction            | .40*** | .39*** | .25*** | .39*** | - .59*** | - .61*** | - .33*** | - .61*** |
| L. functional health        | 0.00 | 0.03 | 0.06 | 0.03 | .30*** | .25** | .40*** | .25** |
| L. optional PLI             | .00 | .09+ | -0.13+ | .00 | .00 | .00 | .00 | .00 |
| 2 S functional health (SFH) | .18** | .74** | .18** | .25*** | .97*** | .25*** |
| S optional PLI (SOP)        | 0.04 | 0.05 | .04 | .02 | .02 | .02 |
| 3 SFH × SOP                 | .00 | .00 | .00 | .00 | .00 | .00 |
| ∆R²                         | .15*** | .03* | .00 | .24*** | .06*** | .00 |
| R²                          | .15*** | .18*** | .18*** | .24*** | .30*** | .31*** |

Note. Standardized regression weights (β) are reported for each step. Unstandardized regression weights (B) are only reported for the last step that significantly improved the prediction. All tolerances are above .60. L = Level; S = Slope. *p < .10, **p < .05, ***p < .01, ****p < .001.
Overall, the hypothesized associations between changes in satisfaction, functional health, and PLI were not demonstrated. Contrary to hypotheses, change in PLI selectivity and change in optional PLI were mostly unrelated to change in functional health and change in satisfaction. Moreover, moderating functions of average PLI and optional PLI on the relationship between health and satisfaction were evident when levels were considered but were not found when changes in the respective variables were analyzed. The entire set of hypotheses on associations between changes (3a – 3g) was hence not confirmed, either because hypotheses could not be tested in the first place (as for average PLI and obligatory PLI) or because there were no significant associations. A possible explanation for the differential findings regarding levels and slopes is that most participants showed only small or even no change in functional health. Possibly, buffering effects of change in PLI selectivity or change in optional PLI would only emerge with greater losses in functional health.  

Summary: The functional role of PLI. Overall, hypotheses 3a – 3g were mostly supported with the cross-sectional information on initial or characteristic levels in the longitudinal sample. When zero-order correlations were considered, level of functional health was positively related to average PLI level and optional PLI level, negatively related to level of PLI selectivity, and unrelated to level of obligatory PLI (as predicted by hypothesis 3a). In line with hypothesis 3b, level of life satisfaction or aging satisfaction tended to be positively related to level of average PLI and level of optional PLI, negatively related to level of PLI selectivity, and unrelated to level of obligatory PLI. Once the impact of health level on satisfaction was accounted for in the regression analyses, average PLI level and PLI selectivity level mostly lost their associations with satisfaction levels. However, the relationships between level of optional PLI and level of life satisfaction or aging satisfaction remained significant and positive: Optional PLI contributed to higher satisfaction. The interaction between average PLI and functional health in predicting

17 To examine this possibility, a post hoc analysis was performed. Based on the individual slopes of functional health two extreme groups of participants were formed. Those people whose health declined most (bottom 35% of the sample, n = 73) were compared to those people whose health showed only minimal decline, was stable, or even increased (top 35% of the sample, n = 73). The hierarchical regression analyses with change in satisfaction as the dependent variable were then repeated with a dummy variable indicating extreme group for change in health (health group) instead of the health slope. The previous findings were again obtained: Level of satisfaction and health group were related to change in satisfaction across all analyses. The level of functional health again added to the prediction of change in aging satisfaction but not to the prediction of change in life satisfaction. Change in PLI selectivity was positively related to change in life satisfaction. However, although the beta weights for interactions between PLI slope and health group were somewhat bigger than the respective beta weights reported in Table 18 and were in the expected direction, they still did not reach significance. Specifically, in the regressions with life satisfaction slope as the dependent variable beta weights were β = .10, p = .35, for the interaction between health group and PLI selectivity slope and β = .07, p = .47, for the interaction between health group and optional PLI slope. With aging satisfaction slope as the dependent variable, the respective beta weights were β = .15, p = .12, for the interaction between health group and PLI selectivity slope and β = .14, p = .13, for the interaction between health group and optional PLI slope. Thus, the extreme group analyses also failed to demonstrate the predicted associations.
satisfaction that had been demonstrated in previous studies (Staudinger & Fleeson, 1996; Staudinger et al., 1999) was replicated—this time with a slightly different health indicator and in a reduced sample. As maintained in hypothesis 3c, average PLI level moderated the association between functional health level and satisfaction level. In contrast, the predicted moderating function of PLI selectivity on the association between health level and satisfaction level (hypothesis 3d) was not found: Only in the analysis with aging satisfaction level as the dependent variable did the interaction between PLI selectivity level and health level reach marginal significance. Hypothesis 3d is thus rejected.

The distinction between optional PLI and obligatory PLI helped to shed further light on the interaction between average PLI and health in predicting satisfaction: As expected (hypothesis 3e), the level of optional PLI interacted with the level of functional health such that the relationship between health and satisfaction became smaller at lower levels of optional PLI. In line with hypothesis 3f, no interactions between level of obligatory PLI and level of functional health were obtained. Thus, low optional investment especially was adaptive at low levels of functional health. Moreover, the expected interaction between level of obligatory PLI and level of optional PLI in predicting satisfaction was found (hypothesis 3g). The highest correlations between level of optional PLI and level of life satisfaction or aging satisfaction emerged at the highest level of obligatory PLI.

Parallel to the analyses in the validation part (section H1), I again tested whether the cross-sectional findings reported here for the longitudinal sample ($N = 206$) also hold true in the entire cross-sectional sample ($N = 511$) to ensure the generalizability of findings. The respective analyses are reported in Appendix D2. By and large, the results from the longitudinal sample are supported by the regression analyses with T1 data from the entire cross-sectional sample. Still, there are two differences worth noting. First, regression weights and portions of explained variance tend to be smaller in the cross-sectional sample. This is most likely due to the use of less reliable variables (T1 data instead of estimated initial or characteristic levels). A genuine difference between the longitudinal and cross-sectional sample concerns the interaction between levels of obligatory PLI and optional PLI. The interaction is present in the longitudinal sample but clearly absent in the cross-sectional sample (cf. Appendix D2). Instead, obligatory PLI is negatively related to satisfaction in the cross-sectional sample.

The zero-order correlations between slopes and the results from regression analyses predicting change in satisfaction did not support hypotheses 3a – 3g. No significant correlations between change in health or change in satisfaction and change in PLI selectivity or optional PLI were found. Further, no significant interactions between health slope and PLI slope were obtained in the regressions. Change in PLI selectivity turned out as a significant predictor of change
in life satisfaction once initial levels of predictors and health changes had been considered. Other PLI slopes or levels, however, were usually not predictive of change in satisfaction. The lack of significant associations or interactions between slopes may be attributable to the small amount of change in functional health and PLI that occurred in the longitudinal sample.
I Discussion and Conclusions

This study investigated the development and functionality of the amount and distribution of personal life investment in old and very old age. PLI was conceptualized as one basic element of life composition (Staudinger, 1999b). That is, PLI can help to understand some of the processes that operate when individuals attempt to master life in their actions and reactions. Employing the perspective of life composition also requires taking the role of developmental contexts seriously. The adaptivity or functionality of self-regulatory functions can only be judged against the background of a person’s developmental context (e.g., P. B. Baltes et al., 1998; Brandstädter, 2001; Heckhausen & Dweck, 1998; Staudinger et al., 1995; Staudinger, 1999b). Developmental contexts put some constraints on the possible distribution of motivational energy. Age-related opportunity structures and demands dictate which goals and tasks require investments if a basis for further development is to be maintained. The distinction between obligatory PLI and optional PLI was made to differentiate investment in life domains that should receive some share of investment (obligatory, i.e., health, cognitive fitness, family, independence, life reflection, death and dying) from investment in life domains that may receive some share of investment (optional, i.e., leisure, friends, sexuality, work) during old age. This distinction helped to study the multidirectionality and multifunctionality (cf. P. B. Baltes et al., 1998) inherent to personal life investment. That is, the average amount of PLI and the distribution of PLI across life domains do not tell the entire story. Rather, obligatory PLI and optional PLI were found to develop differently and also show different functional relations. The distinction between the two facets of PLI proofed to be useful both theoretically and empirically, and it may be beneficial to consider this distinction in future studies on self-regulation.

Three major issues were addressed in this study. The first concerned the relations between average PLI, PLI selectivity, obligatory PLI, and optional PLI (the four PLI facets) and other elements of the self-system that operates when individuals try to master life (i.e., personality dispositions, current and possible selves, and activities). The demonstration of associations between PLI and other elements of the self-system was intended to add to the validation of the PLI construct in general and the distinction between obligatory PLI and optional PLI in particular. Second, the development of the four PLI facets was studied. In addition, developmental change in obligatory PLI and optional PLI were investigated in concert and it was determined whether obligatory PLI has a dominant impact on optional PLI rather than vice versa. Finally, the third issue pertained to the functional role of PLI for successful aging. Specifically, tests were done to determine whether changing one’s PLI can help to buffer the negative impact of deteriorating functional health on satisfaction with one’s life in general or aging in particular. As specified in the relational model of plasticity (cf. B2; Staudinger & Greve,
In this final chapter, I will first summarize and discuss the findings separately for each of the three major issues. I will further consider implications and limitations that are specific to each part. Finally, some general conclusions are drawn about the functionality and development of personal life investment. An attempt is made to describe the successful aging process in terms of adaptive changes in personal life investment.

Personal life investment has been related to other elements of life composition. A small overlap was expected between what is assessed in terms of personality dispositions, current and possible selves, activities, and PLI. And indeed, PLI showed relations with these other elements of life composition: The self-regulatory functions measured with the PLI Schedule were in part also captured by assessments of personality, self-concepts, and activities. However, PLI also measured self-regulatory functions that were not already included in alternative self and personality constructs. This speaks to the discriminant and convergent validity and utility of the PLI construct: PLI is systematically related to other self-regulatory constructs but still makes a unique contribution to understanding processes of life composition.

However, this global statement needs some further qualifications. First of all, average PLI, obligatory PLI, and optional PLI each were related to one or another of the personality, self-concept, or activity variables. In contrast, no such associations were found for PLI selectivity. It has been argued that PLI selectivity is not a matter of personality but rather a matter of resources and developmental contexts (pp. 51 – 52; Staudinger & Schindler, 2005). The results of this study supported this assumption: PLI selectivity was largely unrelated to personality dispositions. Moreover, PLI selectivity was inversely related to functional health (cf. H3). Thus, PLI selectivity was higher when resources were limited (i.e., when functional health was poor). However, PLI selectivity also failed to demonstrate the predicted associations with self-concept and activity variables. This may be due to a dependency between average PLI and PLI selectivity at the highest and lowest levels of average PLI: PLI selectivity is by necessity low in those participants who have reported the lowest average PLI and also low in those participants who have reported the highest average PLI. This property may preclude observation of linear relationships between PLI selectivity and self-concepts or activities. In support of this assumption, a quadratic relation-
ship between PLI selectivity and the number of different self-defining domains can be shown.\textsuperscript{18} Participants with few self-defining domains and participants with many self-defining domains reported lower PLI selectivity than participants with an intermediate number of self-defining domains. Thus, computing PLI selectivity as the intraindividual variability across PLI ratings can complicate the demonstration of associations, as potential quadratic relationships need to be considered in addition to linear relationships. This would be less of a problem when studying people who usually do not choose the lowest possible PLI rating in several PLI domains. But the old and very old participants in the BASE sample reported PLI values pretty much across the entire range of possible PLI scores (cf. Appendix A1). This leads to the described problem of the highest PLI selectivity scores being ambiguous as to their meaning and functionality.

**PLI and personality dispositions.** Let me now discuss the results of the first part of the study separately for personality dispositions, self-concepts, and activities. Personality dispositions demonstrated stronger associations with average PLI, obligatory PLI, and optional PLI than current and possible selves or activities. The personality dispositions in this study were selected to represent both “positive” dispositions (extraversion, positive affectivity, openness, internal control beliefs) that may facilitate the attainment of personal goals or represent affective responses to successful goal striving and “negative” dispositions (neuroticism, negative affectivity) that may sometimes interfere with goal attainment or represent affective reactions to failure at goal striving. In addition, the distinction between obligatory PLI and optional PLI served to highlight that the more “negative” dispositions do not necessarily play out in any context or are relevant to any kind of goal striving. This joint consideration of psychological (personality dispositions) and non-psychological (obligatory and optional life domains) developmental contexts led to some interesting findings. As hypothesized, obligatory PLI, and also average PLI, were positively related to indicators of approach temperament (positive affect, extraversion) and indicators of avoidance temperament (negative affect, neuroticism). Optional PLI was only positively related to indicators of approach temperament. Thereby, the positive and negative affective components of extraversion and neuroticism seemed to account for the association between extraversion or neuroticism and PLI. After affect had been considered, the two personality traits were mostly unrelated to PLI.

Overall, the prediction that avoidance temperament does not play out equally strongly in every context was supported. Obligatory life domains that “enforce” some investment to avoid negative outcomes, but not the more optional life domains, were conducive to the expression of avoidance temperament, as evident in the positive associations between negative affectivity and

\footnote{When the number of self-defining domains is simultaneously regressed on PLI selectivity and squared PLI selectivity, significant associations are found, $R^2 = .02, F(2, 495) = 5.13, p < .01, \beta_{\text{linear}} = .06, \beta_{\text{quadratic}} = -.13$.}
PLI. Here, people high on avoidance temperament may tend to formulate avoidance goals that contribute to investment in the form of worry or rumination. Striving to accomplish goals in obligatory life domains may further be accompanied by more negative affective reactions in people high on avoidance temperament—especially if attempts to attain the goal are unsuccessful. This association between avoidance temperament and obligatory PLI may be especially pronounced in old and very old age, when obligations are centered around managing losses, disengaging from ultimately unattainable goals, and accepting the finitude of one’s life.

As expected, openness to experience showed positive relations with all PLI facets (except for PLI selectivity), even when the other personality traits were partialled out. Although openness is not usually considered in the literature on approach and avoidance temperaments, theoretical considerations and also the reported findings point to openness as another indicator of approach temperament. Openness may foster investment in terms of “philosophical” thought and seeking out new experiences—aspects of engagement with life that are not captured when considering only extraversion and positive affectivity. It would thus be interesting to consider openness in future studies on the relationship between approach temperament and investment in personal goals.

In contrast to the other personality dispositions, internal control beliefs did not show the predicted positive relations with PLI facets. Correlations between internal control beliefs and PLI were small and often nonsignificant. Once rival predictors had been considered, no PLI facet was significantly related to internal control beliefs. What may account for these findings? First, as illustrated in the teleonomic model of well-being (Figure 7, p. 98; cf. Brunstein, Schultheiss, & Maier, 1999), investing in a goal does not guarantee goal attainment. The actions a person takes may fail to produce the desired outcomes. Here, investment may actually lead to a diminished sense of control. Furthermore, the feeling of not being in control (for instance because resources for goal attainment are lacking) can contribute to more investment in terms of worrying or trying to disengage from goals. Second, the commitment to a goal influences whether a person actually wants to invest in goal striving. Stated in colloquial terms: If the goal is not important to me, I will not try to reach it, even if I could. If someone believes that, in general, he or she can control important things in life, this does not imply that this person will invest a lot of effort in any and every goal one could come up with (which is a possible disadvantage of nomothetic approaches to personal goals). Third, as already mentioned in the theory part (pp. 54 – 55), not all life domains are of equal relevance to global control beliefs (cf. Lachman & Weaver, 1998). Control over optional life domains especially may be less relevant to beliefs about whether one is in control of one’s life in general than control over obligatory life domains.
Clearly, the suggested explanations are not equally suited to interpret the findings for all PLI facets. The lack of association between optional PLI and internal control beliefs may, on the one hand, be due to the reduced importance of optional life domains. Once people no longer consider optional life domains as important they will not try to reach domain-specific goals. On the other hand, domain-specific control beliefs in optional life domains as compared to obligatory life domains may be of lower relevance to the formation of global control beliefs. That is, global control beliefs may not reflect how much control a person believes to have over optional pursuits. Consequently, global control beliefs would not predict PLI in optional life domains, whereas domain-specific control beliefs would. This assumption is supported by the reported analyses of unpublished PLI data from another sample of older adults (p. 54), which showed that domain-specific control beliefs in optional domains were positively correlated with domain-specific PLI ($r = .60$). Moreover, the correlations between domain-specific control beliefs and PLI in optional domains were even higher than the respective correlations in obligatory domains.

In contrast, how well one is doing in obligatory life domains is expected to remain important to old people and to be relevant to their global control beliefs. The lack of association between obligatory PLI and control beliefs may thus be attributed to the fact that not all kinds of investment lead to goal attainment. Some goals related to health or independence may be out of reach during old age, no matter how hard one tries. Moreover, whether one believes one is in control or not should be irrelevant for PLI with some obligatory goals. Avoidance goals especially, which frequently occur in obligatory life domains, were considered to demand investment regardless of control potential (cf. Higgins, 1997): Important avoidance goals can turn into necessities. Here, one needs to do whatever possible to prevent the feared outcome, even if success is unlikely.

**PLI and current and possible selves.** Current and possible selves were also related to average PLI, obligatory PLI, and optional PLI. Here, current self-definitions were more predictive of optional PLI than possible selves, which did not add to the prediction of optional PLI once the current self-definition was considered. In contrast, hoped-for and feared selves rather than the current self-definition made a unique contribution to the prediction of obligatory PLI and average PLI. These findings may in part be attributed to the few possible selves that were identified in optional domains. Most participants named possible selves in obligatory domains or domains that were not categorized as either obligatory or optional (cf. Smith & Freund, 2002). It again underlines the different functionalities of obligatory PLI and optional PLI. To the degree that optional PLI serves to occupy one’s free time and optimize one’s current affective balance, optional investments may be primarily dependent on how one defines oneself in the present and
not so much on future possibilities. In contrast, what may happen in the future in obligatory domains and the related goals and plans should be highly relevant to obligatory PLI. Obligatory PLI may often be in the service of a long-range plan and not so much in service of affect optimization. That is, investments are made to achieve or avoid future outcomes rather than to have a good time and are thus closely related to future possible selves.

**PLI and activities.** Compared to personality dispositions and current and possible selves, activities, overall, were less closely related to PLI. Specifically, activities accounted for some unique variance in optional PLI but not in obligatory PLI or average PLI. Now, can we conclude that obligatory PLI is unrelated to what a person actually does? First of all, we have to consider that obligatory activities are harder to define and match to a specific PLI domain compared to optional activities. It is, for instance, easier to determine whether someone spends time with friends or engages in a hobby than to determine whether an activity is in service of one’s cognitive fitness or independence. The correspondence between obligatory PLI and activities is thus limited for practical reasons. Moreover, obligatory activities are usually performed by everyone. People may not spend equal amounts of time engaging in obligatory activities but eventually everyone will engage in them. This leads to the question of what accounts for the relationship between activities and PLI: Is it the different amount of time spent in an activity category or is it rather activity engagement as indicative of different developmental contexts and opportunity structures? The percentage of time that a person spends on some activity may not be the best indicator of energy investment. Activities can take a long time because they are difficult to perform and demand a lot of energy and effort. Activities can also take long because one is not really motivated to perform them and, thus, is not investing much energy. Relations between the activities of one day and PLI may only become evident once activity engagement is indicative of different developmental contexts that limit or foster investment. The portion of time that is spent in an activity, in contrast, may not matter much. Once every person of a given age group has adequate opportunity structures and is motivated to engage in an activity, correspondence between activity engagement and PLI may become limited. The obligatory life domains of a given age group are usually the domains where almost everyone is able and willing or forced to invest. The finding that obligatory PLI was not related to activities, whereas optional PLI was related to activities, matches the suggested interpretation. In sum, activities probably are related to PLI if not everyone in the sample is able or motivated to engage in them.

**Limitations and suggestions for future studies.** Due to time constraints in BASE, the assessment of personal life investment had to be rather brief. Ten central life domains during old age were selected and participants provided a global investment rating for each domain. In future studies
on goal striving in old age, it would be desirable to have more time available so that more than one goal dimension per domain can be assessed. Here, it should be beneficial to independently measure various kinds of investment that were combined in one global rating in this study. Specifically, investments that aim at goal accomplishment should be separated from forms of investment that do not contribute to goal accomplishment, such as worrying or ruminating. The assessment of different forms of investment could also help to further validate the distinction between obligatory PLI and optional PLI: Investment in terms of worry or rumination should be more frequent in obligatory life domains compared to optional life domains. Furthermore, the consideration of goal dimensions like success, importance, or control, in addition to investment, would be necessary for a more fine-grained analysis of self-regulatory processes, their development, and their functional relations.

The conclusions on the correspondence between PLI, current and possible selves, and activities are limited for several reasons. First, the originally reported current and possible selves and activities of the participants were not available in this study and thus could not be newly categorized as indicative of the ten PLI domains. Rather, previous codings that had been developed in other studies with other research questions were matched to the PLI domains, which may have led to a loss of relevant information and wrong categorizations of some current or possible selves and activities. Furthermore, the considered time spans differed between assessments of the different aspects of life composition: PLI was assessed with regard to the last months, current self-concepts with regard to now, possible selves with regard to sometime in the future, and activities were assessed with regard to one day (that was not part of the last months relevant to the PLI ratings). With these limitations in mind, the reported associations between PLI, self-concepts, and activities seem all the more remarkable. Stronger relationships may have been obtained if the original selves and activities had been categorized anew. However, the new categorization of the activities of one week as indicative of nine PLI domains in the Hornig (2003) study did not lead to higher associations between PLI and activities—probably also due to the relatively small sample size ($N = 75$). In future studies, it would be desirable to ask the participants themselves to which life domain a specific self or activity belongs. In addition, it would be better to assess possible selves prior to PLI, and to assess PLI and activities during the same time interval. It would require these kinds of additional studies to determine whether the interpretations offered above hold true. Is optional PLI really more related to current selves than to future possible selves or is this finding attributable to the few possible selves that were categorized as optional? Are activities related to PLI merely because they are indicative of different opportunity structures or do we need to consider the amount of time spent engaging in an activity in addition? Is the amount of time spent engaging in obligatory activities, which can be
and are enacted by everyone, irrelevant to obligatory PLI or do we just need to improve the categorization of activities?

Second, it remains an open question whether the associations between obligatory PLI and optional PLI and approach and avoidance temperaments hold across the entire adult life span or whether they are specific to old and very old age. My proposal is that the mixed nature of obligatory PLI (approach and avoidance) is evident throughout adulthood but becomes especially pronounced during late life when obligations are mostly centered on loss management. The positive association between neuroticism and average PLI obtained in a sample ranging in age from 14 to 103 years (Staudinger & Schindler, 2005; BASE participants were included in this study) supports the notion that some “negative” forms of engagement are comprised in average PLI at any age. Emmons and Diener (1986) also found that for students the amount of time spent in obligatory activities—namely, studying and working—was positively related to negative affect. Nevertheless, thorough investigations of correlations between obligatory PLI, optional PLI, and indicators of approach and avoidance temperaments would be necessary to demonstrate that obligatory PLI is linked to approach and avoidance temperaments and optional PLI is predominantly linked to approach temperament also during young and middle adulthood.

Third, the relationship between PLI and internal control beliefs needs to be clarified in future studies. The suggested consideration of additional goal dimensions like success or importance and the distinction between various forms of investment would help to accomplish this aim. In addition, general and domain-specific control beliefs should be considered. It would be interesting to see whether general control beliefs are more related to domain-specific control beliefs in obligatory life domains than to domain-specific control beliefs in optional life domains. Another intriguing question is whether higher associations between domain-specific control beliefs and PLI in optional domains compared to obligatory domains, but lower associations between global control beliefs and optional PLI compared to obligatory PLI would be found within the same sample of older adults. And again, it would be interesting whether this pattern is specific to old adults or generalizes to younger and middle-aged adults.

The established link between PLI and current and possible selves also helps to identify life domains that may be added to the PLI Schedule. The PLI Schedule already includes central life domains. Still, in matching the PLI domains with the content categories of current and possible selves it became evident that there are some self-defining goals that are not captured by the PLI Schedule: People define themselves in terms of personal dispositions and hold goals that aim at maintaining or changing personal dispositions. For instance, people may want to be more emotionally stable, less hostile, or more accepting of themselves. Presently, the PLI Schedule primarily measures engagement with the external world but not investment in such self-focused
goals that become evident in people’s self-definitions or possible selves. It may be interesting to add domains like “self-improvement” or “emotion regulation,” especially if PLI is to be linked to the self-concept. In line with this proposal, domains like “personal growth,” “self-presentation,” or “self-trait” were often identified in studies where people’s idiographic goals were categorized (cf. Table 1, pp. 26 – 29).

Similarly, in trying to link PLI with daily activities, it became evident that the meanings of some PLI domains, such as independence, life reflection, or occupation-like activities are somewhat ambiguous. Independence, for instance, is a multidimensional construct (e.g., M. M. Baltes, 1995; Schmid-Furstoss, 1990) that includes many ways in which an individual may or may not depend on others, such as physical independence, cognitive independence, or financial independence. More specific formulations of life domains may facilitate demonstration of associations between PLI and activities in future studies.

2 Late-Life Development and Dynamics of Personal Life Investment

Predictions of the late-life development of PLI were again based on the distinction between obligatory PLI and optional PLI. On average, old people were assumed to continue doing what is required by their developmental context and thus to maintain their obligatory investment. In contrast, resource losses were expected to demand rescaling of goals and reducing investment in optional life domains. As losses become especially prominent and severe during the fourth age (e.g., P. B. Baltes, 1997; P. B. Baltes & Smith, 1999, 2003), reductions in optional PLI were expected, especially during the onset of the fourth age. The predicted developmental trajectories of average PLI and PLI selectivity were based on the assumed changes in obligatory PLI and optional PLI and on previous findings that suggested slightly declining average PLI and increasing PLI selectivity with increasing age (e.g., Freund & Baltes, 2002; Lang, Rieckmann, & Baltes, 2002; Staudinger et al., 1999). Still, to arrive at more specific predictions regarding developmental trajectories, it was of paramount importance to consider the time spans across which change has been measured. The observation of reliable change during old age often requires consideration of time spans of more than six or even ten years (e.g., Zelinski & Burnight, 1997). Thus, it was assumed that change in PLI facets becomes evident mostly only when change is studied across the entire age range included in BASE (more than 30 years) rather than when change is studied across time in BASE (up to 10 years). Predictions thus were specified such that no mean level changes in average PLI, PLI selectivity, and obligatory PLI, and some decline in optional PLI were predicted across time-in-study (10 years). Change was assumed to become evident across age-at-measurement (an age range of 31 years): Average PLI and optional PLI
were expected to decline, PLI selectivity was expected to increase, and obligatory PLI was expected to remain unchanged.

Nevertheless, it was not maintained that these developmental trends are characteristic of all participants. Depending on the individual developmental context and personal resources, people may show various kinds of change in PLI facets. Resources may become limited to such an extent that even obligatory PLI cannot be maintained on high levels. Alternatively, developmental contexts may be more or less demanding and thus ask for more or less obligatory PLI. Here, it was also considered that changes in obligatory PLI and optional PLI may not be independent of each other. A central assumption was that people can change their optional PLI without also changing their obligatory PLI. In contrast, changes in obligatory PLI were predicted to be accompanied by change in optional PLI. If, for instance, severe resource losses require reduction of obligatory investment, these resource losses are assumed to simultaneously require reduction of optional investment.

**Change in the four PLI facets.** The overall picture of development in the four PLI facets was as hypothesized: No mean level change was detected when PLI was modeled across the up to 10 years in BASE. When PLI was studied across the entire age range between 70 and 101 years, some change became evident. Specifically, mean levels of average PLI in the longitudinal sample demonstrated no significant change across the ten years in BASE and also no significant change across the age range included in BASE. In line with this finding, participants’ age was unrelated to initial levels and slopes of average PLI when studied across time-in-study. Interindividual variability in change was evident in both analyses. However, variability in change across age was only detected when change was limited to participants between 80 – 81 and 90 – 91 years. Participants between 80 – 81 and 90 – 91 years seemed to be most variable in their individual slopes. In contrast to the longitudinal sample, a significant age-related decline of average PLI (-4.5 POMP units) between 80 – 81 and 90 – 91 years was found in the cross-sectional sample.

Mean level of PLI selectivity remained unchanged both across time and across age. Interindividual variability in change was indicated when change was studied across time but not evident when change was studied across age. That is, in addition to no mean level age-related change in PLI selectivity, no meaningful change on the level of individual participants was detected when change was modeled across age. In contrast to these findings, participants’ age was found to be related to initial levels of PLI selectivity, such that older people started on higher levels of PLI selectivity. As otherwise no systematic change toward higher PLI selectivity with increasing age was observed, this finding can probably be attributed to sampling biases in the longitudinal sample. Participants over 90 years were selected for higher PLI selectivity while younger-old participants tended to be selected for lower PLI selectivity. In combination, these
sampling biases may account for the higher initial levels of PLI selectivity that were found in the oldest-old participants. The higher overall level of PLI selectivity in the cross-sectional sample points in the direction of the longitudinal sample being predominantly selected in terms of lower PLI selectivity—apart from the 19 participants who were 90 years and older at T1 and were selected for higher PLI selectivity. Furthermore, the repeated analysis of change across time-in-study with only three measurement occasions in section H3 indicated a slight overall decline in PLI selectivity in the longitudinal sample. Thus, findings for PLI selectivity were more inconsistent compared to the findings for the other three PLI facets. Still, in combination the obtained results point to average level stability of PLI selectivity.

Findings were most consistent and in line with predictions for obligatory PLI. No mean level change was found in any analysis. There were also no associations between age and levels of obligatory PLI. Levels in the longitudinal and cross-sectional sample did not differ. Nevertheless, when obligatory PLI was modeled across time-in-study, interindividual differences in slopes were again found. That is, on average, obligatory PLI was highly stable during old and very old age, but even obligatory PLI changed in some participants. No interindividual variability in trajectories was detected when obligatory PLI was studied across age.

Optional PLI also did not show much average level change across time-in-study, although a quadratic change function best fit the data. When modeled across the entire age range included in BASE, optional PLI was found to be stable during the seventies, to decline during the eighties, and again to be stable during the nineties. Interindividual variability in trajectories was detected in the models across time and age. With the model across age, again, variability in change was only found between 80 – 81 and 90 – 91 years. In line with the observed decline during the eighties, participants’ age was negatively related to their initial levels of optional PLI in the LDS model across time-in-study: Older people started on lower levels of optional PLI. The decline between 80 – 81 and 90 – 91 years that was found in the entire cross-sectional BASE sample was larger than the decline found in the longitudinal sample (-9.0 vs. -4.3 POMP units). Here, we again have to consider the selectivity estimates for optional PLI in the longitudinal sample. A small positive experimental selectivity effect was obtained with participants over 90 years. This implies that decline in optional PLI may have been underestimated in the longitudinal sample, as optional PLI during the nineties was higher in the longitudinal sample compared to what would be expected in the general population.

To sum up, PLI development, on a population level, can be described as follows: All PLI facets were highly stable during the third age. With the beginning of the fourth age, optional PLI started to decline in many people. Still, this decline was not normative, that is, optional PLI may well have been stable or increased even in the oldest-old participants. Average levels of optional
PLI again stabilized during the nineties. One may expect PLI selectivity to increase along with declining optional PLI. However, it should again be considered that in the present study PLI selectivity was dependent on average PLI such that PLI selectivity is necessarily low on the highest levels of average PLI and on the lowest levels of average PLI. If older people first increased PLI selectivity and then reduced PLI selectivity, and did so beginning at different ages, the resulting average trajectory would have been largely unchanged—as observed in this study. Mean levels of obligatory PLI did not change during old age. And finally, average PLI, as the mean across obligatory and optional PLI domains, showed the expected intermediate pattern of a small decline during the eighties and stability before and after this decade. The longitudinal and cross-sectional data showed a different amount of change in optional PLI and average PLI during the eighties. Which finding gives the more accurate picture of late-life development of the two PLI facets? It is possible that cohort effects are responsible for the greater amount of change observed in the cross-sectional sample. However, my assertion is that decline in the longitudinal sample was underestimated. The selectivity analyses showed that participants in their seventies and eighties in the longitudinal sample were representative of the initial cross-sectional participants in these age groups. But participants aged 90 and older in the longitudinal sample were positively selected in terms of higher optional PLI. Combining the “representative” octogenarians with the positive selection of nonagenarians in one analysis may have led to a smaller estimated decline in the longitudinal sample.

Finally, mean level changes of the four PLI facets in the population cannot be generalized to individual persons. As would be expected of every construct that measures aspects of self-regulation, change in PLI was highly variable. Changes in a person’s psychological and non-psychological developmental contexts are assumed to account for this variability.

Associations between obligatory and optional PLI. When obligatory and optional PLI were combined in a bivariate LDS model across time-in-study, they showed the predicted association: The initial levels and also the linear slopes of obligatory and optional PLI were positively correlated. Obligatory and optional PLI hence tended to change together. Thereby, change in obligatory PLI impacted on simultaneous change in optional PLI. But change in optional PLI had no impact on simultaneous change in obligatory PLI. Older people often reduced or increased their optional PLI without simultaneously changing their obligatory PLI. In contrast, when older people changed their obligatory PLI, they also showed similar changes in their optional PLI. It may be concluded that resources are first invested in meeting one’s obligations and then remaining resources are devoted to more optional pursuits. If investment in obligatory domains is to be cut back, so is investment in optional domains. In contrast, reducing one’s
optional investment has no impact on one’s obligatory investment: Obligatory PLI can be maintained on high levels while optional PLI is reduced.

In contrast to the reported contemporaneous associations between obligatory PLI and optional PLI, lead-lag relationships between change in obligatory PLI and change in optional PLI were not evident. Theoretically as well as on the basis of the contemporaneous findings, lead-lag relationships between the two PLI facets could be expected. Still, self-regulation operates across very short time spans. BASE was, however, not designed to study the dynamics of self-regulation but rather to observe long-term age-related development. With more than one year between measurement occasions, the dynamic interplay between different components of self-regulation can hardly be studied.

**Limitations and suggestions for future studies.** The latent difference score (LDS) models employed in this study rest on several simplifying assumptions that may not always be tenable or even testable. Most importantly, all individual trajectories are assumed to belong to the same overall group curve (e.g., Ghisletta & McArdle, 2001), that is, all individuals may be described by the same general change function, although some individual variability in change is permitted. This assumption may be of special interest with the LDS models across age, where the collective 30-year age gradients were computed from the up to 10-year individual age gradients (see also Singer, Verhaeghen et al., 2003). Birth-cohort effects and selective dropout (especially age group-specific selective dropout) may have led to biased age gradients. Furthermore, many of the seventy to eighty year-olds in BASE will die or already have died before their ninetieth birthday. Thus, it is a strange thought that those people can be described by the same developmental curve as the ninety or even hundred year-olds. Put differently, the age-related changes observed between 70 and 85 years in the general population are probably *not* a good representation of developmental change in centenarians when they were between 70 and 85 years old (cf. Rott et al., 2001). When young-old, old-old, and oldest-old BASE participants are combined, the resulting 30-year age gradient may, on the one hand, underestimate negative late-life development in PLI as the estimated overall developmental decline is based on a positive selection of nonagenarians. The observed discrepancies between age gradients in the longitudinal and cross-sectional sample support this interpretation. On the other hand, developmental change in those people who will become nonagenarians or even centenarians is probably overestimated when their developmental trajectories are predicted on the basis of the general population of septuagenarians and octogenarians.

A similar argument can be made with the LDS models across time-in-study. For instance, the quadratic change function for optional PLI indicated that people, on average, tended to slightly reduce optional PLI at first but then re-increased optional PLI such that no overall
change resulted. And some participants with four PLI assessments actually showed this trajectory on the individual level. Still, those people who had reduced optional PLI between T1 and T3 and then died after this second PLI assessment clearly had no chance to re-increase PLI. Comparisons of participants with two and three PLI occasions and participants with four PLI occasions did not indicate differences in optional PLI gradients (cf. Appendix C1). However, these tests do not help to solve the issue at hand: Participants with only two measurement occasions contributed information only to the estimation of the first (declining) part of the curve but not to the subsequent (increasing) part. Consequently, they cannot produce any mismatch there. Average level stability of optional PLI across time was thus descriptive of the predominantly younger-old survivors but probably not of the predominantly older-old non-survivors in BASE. Rather, those people who dropped out of BASE after 3 – 4 years in the study are more adequately described as slightly reducing optional PLI.

In sum, the reported average change functions over time-of-measurement and age-at-measurement can at most be generalized to the total population of survivors at a given time or age. Selectivity effects that were evident in the oldest-old longitudinal BASE participants (over 90 years at T1) further limit generalizations. These thoughts pertain primarily to optional PLI, average PLI, and PLI selectivity, the PLI facets that were expected to show some late-life change. The observed average level stability of obligatory PLI, in contrast, seemed to be a quite robust finding.

The few simulation studies on the power of latent growth models to detect group differences in levels and slopes or to detect variability and covariances in slopes (Fan, 2003; Hertzog, Lindenberger, Ghisletta, & von Oertzen, 2004; B. Muthén & Curran, 1997) also point to some limitations of this study. The power of latent growth models to detect medium-sized differences in average levels and average slopes (on a population level) was quite good even with smaller samples (about 100 to 200 participants). However, more than 500 participants were required to achieve a power of .70 to .80 for detecting small differences (Fan, 2003). Sample size, the number of repeated measurements, and the reliability of measures had a strong impact on the power to detect interindividual variability in slopes and covariances between slopes (Hertzog et al., 2004): High reliability of measures (above .85) and many measurement occasions (8 or more) were necessary to reliably detect interindividual variability in slopes or covariances between slopes in small samples (about 100 to 200 participants). With a maximum of four measurement occasions and 206 participants in this study, the power to detect variability in slopes was quite low. Eight-week retest reliabilities for PLI in the .70 range have been obtained (Staudinger et al., 1992), which provide a lower-bound estimate for the reliability of PLI measurements. Although the reliability of the PLI Schedule is thus similar to that obtained with many other self and
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personality measures it does not lie in the .85 or even .90 range. Internal consistencies in the .50 to .70 range have been obtained for the PLI facets. As stated before (cf. G3), these values should not be mistaken as indicative of a moderate or low reliability of PLI. Still, if the similarity of items measuring the construct over time is the crucial factor, moderate internal consistencies of PLI facets may have further limited the power of analyses. Consequently, failure to detect interindividual variability in change in many of the analyses does not warrant the conclusion that there is no such variability. Rather, it may be a result of the reduced power to detect variability in slopes in this study. The present analyses also suggest that variability in trajectories can best be detected when change is modeled across time-in-study rather than age. Once the few measurement occasions were stretched out across the entire age range studied, it became very difficult to detect variability in slopes.

In conclusion, there was most change and also the highest variability in change in optional PLI and average PLI during the eighth decade of life. During the other decades of life, there was less variability in change, such that no significant interindividual variability in change was detected in this study. Moreover, interindividual variability in trajectories also seemed to be lower in obligatory PLI, PLI selectivity, and average PLI compared to optional PLI, that is, variability in slopes was most easily demonstrated with optional PLI.

It would be desirable to study more participants on more occasions in future studies on variability in late-life changes of PLI. However, it would also be very difficult and expensive to obtain a longitudinal sample of about 500 participants who can be studied across eight occasions in old and very old age. The initial BASE sample consisted of 516 participants, of whom approximately 40% had died before the third measurement occasion could be conducted about four years later. Semi-annual assessments would have been necessary to collect a sufficient number of repeated measurements with these people. Nevertheless, as a minimum time interval of six or more years may be needed to observe reliable developmental change in PLI, this strategy would not have been a good solution to the problem. Thus, an easier and more recommended way to enhance the power of analyses would be to further increase the reliability of the PLI schedule. PLI assessment had to be limited to ten items in BASE. In future studies, it may be helpful to measure domain-specific investment with more than one item. This would also increase the internal consistencies of the PLI facets.

An interesting possibility for further analyses with the PLI data is growth mixture models across time-in-study (B. Muthén, 2001, in press; B. Muthén & Shedden, 1999), which allow determination of whether there are groups of people that differ in their trajectories. Initial analyses with the obligatory and optional PLI data provided some interesting preliminary findings. No groups with different developmental trajectories were obtained with obligatory PLI
data. In contrast, two groups were suggested with optional PLI data: One majority group with an average pattern of quadratic decline in optional PLI, that is, an almost linearly declining trajectory at first, which flattened out toward the end. A second very small group of participants (about 30 people) showed increasing optional PLI. This group predominantly consisted of participants in the fourth age who had shown a large discrepancy between obligatory PLI and optional PLI at T1, such that obligatory PLI was quite high and optional PLI very low. These people seemed to reduce this large discrepancy by increasing optional PLI. In trying to find variables that are related to group membership, only one difference between groups was suggested: Participants who increased optional PLI tended to increase the number of emotionally close social partners, whereas participants who reduced optional PLI tended to maintain or reduce the number of close social partners. However, as the group of people who increased optional PLI is very small, group differences do not reach significance. In the future, it may be interesting to further investigate groups of BASE participants who show differential PLI development.

Finally, the BASE data are not optimally suited to study self-regulatory dynamics in old age. The bivariate LDS model introduced in section G5 allowed the determination of the direction of causality between simultaneous changes in obligatory PLI and optional PLI, which is an important first step to study the dynamic interplay of the two PLI facets. Still, the demonstration of cross-lagged associations between obligatory PLI and optional PLI was not possible. Short-term longitudinal studies would be required to study lead-lag relationships between different PLI facets or PLI and other self-regulatory or contextual variables. Here, changes across some weeks or even days could be investigated and linked. As it did not seem promising to further investigate lead-lag relationships between different variables in BASE, the third and last set of analyses focused on correlated changes, that is, concurrent relationships across time. Determining which variables change together and which do not change together is an important first step to arrive at a more thorough understanding of the processes inherent in life composition in old age and successful aging.

3 Personal Life Investment, Functional Health, and Satisfaction

Successful aging was conceptualized as the process of successfully adapting to age-related challenges by employing self-regulatory strategies that help to (re)establish a good person-environment fit, such that a sense of well-being is maintained, despite losses (e.g., M. M. Baltes & Carstensen, 1996; P. B. Baltes & Baltes, 1990; Brandstädter, 2002; Kahana & Kahana, 1996; Schulz & Heckhausen, 1996). Reducing personal life investment or, more specifically, reducing personal life investment in optional domains was considered as an adaptive response when
resources (like functional health) become very limited. Still, when resources are sufficient, high optional PLI was expected to contribute to successful aging. Two indicators of successful aging, namely being satisfied with one's life overall and aging, were at the focus of the last part of this study on the functional role of PLI for successful aging. Initial scores at T1 and change across up to eight years in BASE of PLI facets, functional health, and satisfaction were investigated to determine relationships between the variables and whether PLI can buffer the negative impact of bad functional health on satisfaction.

First, it should be noted that functional health, optional PLI, and PLI selectivity did not show very much (but significant) average level change and interindividual variability in change. With the last PLI occasion not considered, only the first declining part of the quadratic curve for optional PLI that had been found with four measurement occasions was left. The upswing in optional PLI toward the last occasion was no longer evident. The decline in PLI selectivity (-1.8) was significant but quite small and similar in size to the nonsignificant decline found with four PLI occasions (-1.3). Given the previous findings, this cannot be interpreted as a general declining tendency of PLI selectivity in old age. No average level change or interindividual variability in change of average PLI and obligatory PLI was detected once the last measurement occasion for PLI was not considered in the analyses. This may be attributable to the further reduction of power to detect variability in slopes with only three measurement occasions (see I2). Still, it seemed better not to consider change in these two PLI facets in predicting change in satisfaction rather than to use slope scores that may be unreliable and capture a lot of unsystematic fluctuations. Both life satisfaction and aging satisfaction, on average, declined by about 12 POMP units (i.e., about one standard deviation) across eight years and also showed variability in trajectories. Furthermore, change in life satisfaction was correlated with participant's age, such that life satisfaction diminished most in older-old people. Declining satisfaction during old age was thus not primarily related to declining functional health. Rather, it seems likely that the accumulation of losses during old age accounts for the overall declining satisfaction, even though functional health showed little decline. The effects of bereavement, institutionalization, cognitive decline, and so forth on satisfaction have not been considered in this study. Thus, the present findings again underline the limits of the subjective well-being paradox in very old age. Considered as a group, participants in the longitudinal BASE sample (who already represent a somewhat positive selection of older individuals) were not able to maintain their initial level of satisfaction despite age-related losses. When individual participants were considered, however, some individuals with stable or even increasing satisfaction were found. But was PLI able to contribute to this stability?
The contribution of PLI to satisfaction. When only initial levels (cross-sectional data) were analyzed, optional PLI was the only PLI facet that was consistently positively related to life satisfaction and aging satisfaction after the impact of functional health had been considered: People who reported more optional investment were also more satisfied. Thus, for most people optional PLI was a mean of obtaining high subjective well-being. However, this assertion did not hold for those people who faced severe health constraints. Previous findings on an interaction between PLI and health in predicting satisfaction (Staudinger & Fleeson, 1996; Staudinger et al., 1999) were replicated and extended. Higher positive correlations between functional health and satisfaction were obtained at higher levels of average PLI and optional PLI. Reduced average PLI and optional PLI were associated with smaller correlations between health and satisfaction. It may thus be concluded that reducing PLI, and specifically reducing optional PLI, helped to buffer the negative impact of bad functional health on satisfaction. In the longitudinal sample there was also an interaction between levels of obligatory PLI and levels of optional PLI. Optional PLI showed higher positive correlations with both life and aging satisfaction at higher levels of obligatory PLI. High obligatory PLI was thus conducive to high levels of satisfaction when optional PLI was simultaneously high. But high obligatory PLI was also conducive to the lowest levels of satisfaction when optional PLI was simultaneously very low. A large discrepancy between obligatory PLI and optional PLI probably represents a situation where the person becomes preoccupied with her or his health, functioning, and independence. The development of this kind of self-focused goals during old age has been identified as a risk factor to well-being and successful aging on both theoretical (e.g., Peck, 1956) and empirical grounds (e.g., Lapierre et al., 1997). Nevertheless, in the entire cross-sectional sample, this interaction between obligatory and optional PLI was not found (cf. Appendix D2). Rather, obligatory PLI was negatively related to satisfaction once functional health had been taken into account: People who reported higher obligatory PLI were less satisfied with their life and aging. This may again point to a more positive selection of the longitudinal sample in terms of engagement with life. High obligatory PLI can have, but does not need to have, negative consequences for satisfaction. More “successful” agers probably differ in their kinds of obligatory investments from the general population of very old adults, such that high obligatory investment is not generally related to reduced satisfaction but only in specific circumstances. For instance, old people can invest in their health by trying to keep physically active and following the prescriptions of their doctors, but old people can also invest in their health by complaining about functional limitations and worrying over how the situation might get worse. Especially those people who reported very high obligatory PLI and very low optional PLI may lack resources that would allow for high invest-
ment in terms of actively pursuing goals but still may be preoccupied with ruminating over age-related losses or trying to recover unrecoverable resources.

In addition to initial levels, the longitudinal BASE data provided an opportunity to link change in satisfaction with change in functional health and PLI. Here, although satisfaction showed much change across the up to 8-year time interval in BASE, changes in functional health and PLI were small. Moreover, only optional PLI and PLI selectivity demonstrated inter-individual variability in trajectories but not obligatory PLI and average PLI. It was found that initial levels of satisfaction and change in functional health were the central predictors of change in life satisfaction and aging satisfaction. With change in aging satisfaction as the dependent variable, initial levels of functional health were related to change in satisfaction in addition to health changes. Those who started out on higher levels of functional health showed less decline in aging satisfaction. Contrary to predictions, PLI facets did not add to the prediction of change in satisfaction—with one exception: Change in life satisfaction was positively related to change in PLI selectivity when health change was also considered. Declining PLI selectivity was linked to declining life satisfaction but increasing PLI selectivity was related to increasing life satisfaction. Thus, becoming more selective in their investments may have helped older people to remain satisfied with their lives, regardless of change in functional health. However, this association was not found when change in aging satisfaction was considered.

Clearly, losses in functional health were related to diminished satisfaction. Contrary to hypotheses, change in PLI did not seem to have much impact on the relationship between change in health and change in satisfaction. However, it remains an open question how much health change would be necessary for change in PLI to have a positive impact on change in satisfaction. Reducing PLI in reaction to any change in functional health may not be a good strategy. Small changes in functional health may be associated with reduced satisfaction but may not limit one’s potential engagement with life. As long as one’s functional health is good enough to live independently and pursue various goals, reducing investment along with any loss in health or functioning may not qualify as adaptive behavior. Rather, positive effects of limiting one’s investment may become evident only when health losses are so severe that some goals cannot be pursued any more. That is, with little change in functional health PLI may have no effect, but with substantial change in health refocusing investments may be beneficial. To test this possibility, extreme groups for health change were compared in a set of post hoc analyses (footnote 17, p. 197). Here, results moved in the expected direction, but still no significant associations were found.

Limitations and suggestions for future studies. Only one aspect of successful aging, maintaining high levels of satisfaction, was considered in this study. Thereby, findings for the global indicator
of life satisfaction and the domain-specific indicator of aging satisfaction were quite similar. As may be expected (cf. Smith, Borchelt et al., 2002), associations with the more specific indicator of aging satisfaction tended to be somewhat higher. However, satisfaction may not be the most important indicator of successful aging and other indicators may show other associations with PLI. Findings may differ when other subjective well-being measures, such as autonomy, environmental mastery, self-acceptance, positive relations with other people, or personal growth as indicators of psychological well-being (Ryff, 1989), or objective indicators, like survival or mastery of developmental tasks, are considered. For instance, obligatory PLI emerged as a risk factor for reduced satisfaction in some people but may have beneficial effects when other indicators are employed. High obligatory PLI may be related to a higher ability to compensate for health-related losses, organize care, or maintain independent living. As successful aging is a complex phenomenon, it would be desirable to consider additional indicators of successful aging in addition to satisfaction in future studies.

Moreover, the previously suggested distinction between forms of investment that can contribute to goal attainment and forms of investment that cannot contribute to goal attainment and the inclusion of other goal dimensions would help to clarify the contribution of PLI to successful aging in future studies. Negative consequences of obligatory PLI for well-being may be evident only in those people who make investments that cannot help to accomplish goals or in people whose investments fail to produce desired effects. But it is also possible that even obligatory investments that are successful contribute to reduced well-being, just because one had to make investments one did not like to make.

Although this study is based on longitudinal data, conclusions with regard to causal relationships are very limited. As mentioned above, time intervals in BASE are too long to investigate self-regulatory dynamics. Moreover, change in optional PLI, PLI selectivity, and health across eight years was quite small and no significant change in obligatory PLI and average PLI was detected with only three measurement occasions. The hypothesized buffering effect of PLI on the impact of bad functional health on satisfaction was thus only evident with the cross-sectional data but not when change patterns were studied. It cannot be ruled out that this buffering effect is only detectable with substantial change in functional health or with some additional health losses in people who already were in poor health at the beginning of the study. That is, the functional relations between health and PLI in maintaining satisfaction are probably not linear but rather follow a threshold model: Positive effects of reducing optional PLI are only evident when health drops under a certain threshold that is required to keep up some kinds of investment. Participants in the longitudinal BASE sample were selected for better functional health at T1 (Lindenberger et al., 2002; see also Smith & Delius, 2003) and also did not show
dramatic health change. Although it is much more difficult to study people with deteriorating functional health longitudinally, these people would be required to determine whether reducing PLI is adaptive only when health deteriorates beyond a certain threshold.

4 Conclusions

Personal life investment was studied within a system of inner and outer interactions inherent to life composition. PLI was linked to other self-pragmatic constructs that are relevant to life composition. The amount of developmental change in PLI facets was determined and interrelations between change in obligatory PLI and change in optional PLI were demonstrated. PLI also showed some relations with functional health and indicators of satisfaction. The explicit consideration of the role of developmental contexts led to the distinction between obligatory PLI and optional PLI. This distinction proved to be very useful in the study of the development and functionality of PLI in old age, as it helped to understand some of the multidirectionality and multifunctionality of PLI. Future studies on self-regulation or goal striving in old age, and also during earlier phases of the life span, may profit from considering this distinction between what people need to do and what people may do. Although this study had to be limited to some selected aspects of life composition, it provided several insights about the functionality and late-life development of PLI.

Functionality and development of PLI in old age. In general, humans benefit from actively engaging with life and trying to shape their development in accordance with their goals and preferences. However, humans simultaneously need to acknowledge and accept the limits of their ability to influence and control their lives, which becomes increasingly reduced in old and very old age (e.g., P. B. Baltes & Baltes, 1990; Brandstätter, 2001; Brandstätter & Greve, 1994; Freund & Baltes, 2000; J. Heckhausen & Schulz, 1995; Schulz & Heckhausen, 1996). Successful development in general and successful aging in particular can thus be defined as engaging with life in adequate ways. That is, to attempt to make the best of one’s life within a given developmental context. Chronological age and functional health status are two aspects of the developmental context that were studied here. Depending on these contexts, PLI can turn into a resource or risk for successful aging, measured here in terms of subjective well-being.

Now, which patterns of PLI seem most adaptive, given a specific developmental context? To answer this question, let me briefly recount the properties of the PLI facets. Average PLI measures engagement with life overall. To better understand the nature of average PLI, it is useful to distinguish between obligatory and optional PLI. Obligatory PLI comprises the ne-
cessities of development, that is, investments that are made because the current situation enforces
investment or to avoid negative developmental outcomes. Obligatory PLI also comprises investments
that move beyond those necessities. Obligatory PLI thus has a complex nature: It involves
approach and avoidance motivation, may be associated with positive and negative affect, satisfac-
tion and dissatisfaction, becoming more self-actualized and less self-actualized. Often, obliga-
tory PLI is in service of long-term positive development rather than short-term affect op-
timization. Optional PLI, in contrast, represents what people may do with their free time and
resources. It allows for predominantly approach motivation and is primarily related to positive
affective experiences, satisfaction, and self-actualization. An important function of optional PLI
is affect optimization but it may also contribute to long-term positive development. PLI
selectivity is not specific to obligatory or optional PLI but measures the intraindividual variability
in investments across the ten PLI domains. It indicates to what degree a person is selectively
invested in a limited number of domains while simultaneously disregarding other domains.

A person’s age and functional health are important to the functionality of PLI as they are
indicative of the amount of time that a person has left to live and the resources that are available
to her or him. Socioemotional selectivity theory (e.g., Carstensen et al., 1999) has highlighted the
influence of a constrained time perspective on central human motivations. With little time left to
live, people stop pursuing options for long-term developmental gain (information gathering) and
focus more on short-term gains (emotionally meaningful and positive experiences). Focusing on
long-term gains loses its functionality once a person cannot be expected to live long enough to
actually experience those gains. To the degree that obligatory PLI is in the service of long-term
developmental goals it may similarly become less functional with less time left to live. But the
functionality of obligatory PLI also depends on the potential to achieve immediate or short-term
positive effects when investing energy and effort. For instance, investing in one’s health is
beneficial when it helps to, at least temporarily, relieve pain. As optional PLI is focused on
immediate positive outcomes it remains functional even when time perspective is limited.
However, investment also needs to be adapted to one’s resources, such that resource-intensive
investments are cut back when resources diminish. Thereby, people are not completely free to
decide which investments to reduce and which to maintain, but they also need to consider the
demands of their developmental ecologies. Obligatory investments often cannot be reduced, for
instance, a sick person first needs to care about her or his health and then think about other
pursuits.

Taken together, the results of this study suggest that successful aging in terms of adaptive
changes in life investment may be described like this: When functional health status is good in old
age, high levels of optional investment are conducive to high satisfaction with one’s life and
aging, that is, optional PLI is a resource to enhance satisfaction. Obligatory PLI is not generally conducive but also not detrimental to satisfaction. Obligatory PLI may add to high satisfaction when optional PLI is simultaneously high. When optional PLI is very low, high obligatory PLI will be more conducive to dissatisfaction. That is, an overly selective focus on obligatory life domains at the expense of optional life domains constitutes a risk factor for successful aging. The functionality of obligatory PLI also depends on the kind of obligatory investments. As evident in the results of the cross-sectional BASE sample, high obligatory PLI may be detrimental to satisfaction, especially when less positively selected older adults are studied. When obligatory investments help to maintain one’s health, independent living, and positive family relations, they can be expected to have positive consequences for well-being. However, unsuccessful attempts at maintaining one’s health and functioning would be related to increased worrying and disengagement processes that can also be reflected in obligatory PLI. Old people further need to be careful not to make investments in obligatory domains that aim at changing the unchangeable, attaining the unattainable, or avoiding the inevitable (e.g., Wrosch, Scheier, Carver, & Schulz, 2003). In these circumstances, obligatory PLI can again turn into a risk factor for successful aging. When health status becomes worse, it is beneficial to lower optional PLI and maintain obligatory PLI, which results in increasing PLI selectivity. Still, it is important not to overly reduce optional PLI or completely disengage. Rather, reductions need to aim at re-matching one’s optional PLI with one’s resources while maintaining as much optional PLI as possible. Old people not only need to disengage from too demanding goals but they also need to establish other meaningful and manageable goals in order to age successfully (Wrosch, Scheier, Carver, & Schulz, 2003; Wrosch, Scheier, Miller, Schulz, & Carver, 2003). For people in very poor health, optional PLI and, more generally, average PLI can become a risk to satisfaction. When functional health is very poor, the old and oldest old seem to profit most from reducing investment across all or most domains. This implies low optional PLI and low obligatory PLI and, hence, also low PLI selectivity. Maintaining obligatory PLI on very high levels and sharply reducing optional PLI would be dysfunctional in this situation.

The average developmental trends in PLI also support this description of a successful aging process. Starting at age 80, that is, during the beginning of the fourth age for many people, optional PLI was found to decline. And this decline was smaller in the longitudinal BASE sample compared to the cross-sectional BASE sample, speaking to more positive developments in the selected longitudinal sample. No significant average level change was observed in the other PLI facets in the longitudinal sample.

Nevertheless, this study also illustrates the limits to successful aging during the fourth age that have been previously described (e.g., P. B. Baltes, 1997; P. B. Baltes & Smith, 2003). Sub-
Conclusions

Objective well-being declines during the fourth age and it does not seem that this can be prevented—at least on the group level. Thus, “successful” aging during the fourth age may mean developing less negatively than one’s same-aged peers. Reducing PLI may contribute to this relative success only when substantial resource losses are experienced. In this study, where only small to moderate health change was observed, changing PLI did not seem to prevent change in satisfaction. Studies involving shorter time intervals and people with more severe health losses would be needed to study the dynamics between changes in health, PLI, and satisfaction.

A “recipe” for successful aging? Optional PLI turned out as the PLI facet that is related to satisfaction with one’s life and aging over and above the influence of good health. When resources are sufficient, optional investment is related to increased satisfaction. When resources are not sufficient, it is adaptive to cut back optional investments. Now, can we conclude that enhancing or reducing optional PLI would be a way to increase well-being in old and very old people? That is, can we derive subjective well-being interventions based on the present findings?

Indeed, increasing leisure activity or facilitating contact with friends or peers have been considered as intervention strategies to increase well-being in older adults (e.g., Blieszner, 1995; Carpenter, 2002; K. Heller, Thompson, Trueba, Hogg, & Vlachos-Weber, 1991; Parker, Gladman, & Drummond, 1997; Searle, Mahon, Iso-Ahola, Sdrolias, & van Dyck, 1998). However, several issues should be kept in mind before concluding what is good for “the elderly” and what is not. First, when it comes to the benefits of disengaging in appropriate ways, we need to ask whether disengagement is a strategic and controlled process. That is, would older adults benefit from psychoeducational treatments focused on telling them when it is good to disengage and when not? Here, we need to consider that “individuals cannot adjust preferences or disengage from goals merely because it seems advantageous to do so. Accommodative processes need not be, and often cannot be, intentionally enacted” (Brandtstädter, Rothermund, & Schmitz, 1998, p. 374). Rather, many processes involved in accommodative coping or secondary control are automatic (see also Brandtstädter, 2001). Goal disengagement is a resource of an adaptive self-system that is not easily implemented (without psychotherapeutic intervention) if lacking.

Second, the truism “one size does not fit all” also applies here. Interventions need to be in line with an individual’s personality and personal preferences or goals in order to be effective (e.g., Quattrochi-Tubin & Jason, 1983; Reid & Ziegler, 1980). Furthermore, introducing new opportunities for optional investment may be less beneficial to older adults than helping them to maintain or reestablish past optional investments. Following the continuity theory of aging (Atchley, 1989), successful aging also means experiencing continuity in one’s activities and developmental contexts. Similarly, socioemotional selectivity theory (e.g., Carstensen et al., 1999) stressed the importance of established emotionally close social ties, especially to old adults. These

Last but not least, we need to ask how effective subjective well-being interventions are or can be in old age. Meta-analyses demonstrated gains in well-being following interventions with older adults (Burckhardt, 1987; Okun, Olding, & Cohn, 1990; Pinquart & Sörensen, 2001). However, not every intervention is effective or leads to permanent improvements in well-being. Okun et al. (1990) suggested that short-term gains in well-being are evident immediately after interventions but often cannot be maintained following termination of the intervention. The success of interventions may depend on their efficacy in permanently changing developmental ecologies (e.g., Hobfoll & Jackson, 1991). Interventions were also more effective when specifically tailored to the individual (Pinquart & Sörensen, 2001).

Thus, we can conclude that it may not be the best strategy to develop one kind of intervention that aims at enhancing leisure or social activities and apply it to every older person in order to increase well-being. Similarly, telling old people about the potential benefits and costs of optional investment may not help them. Nevertheless, there is one kind of intervention that may facilitate optional PLI in late life: Again, we need to pay attention to the developmental contexts that our society provides for old and very old people (see also Kessler & Staudinger, in press). If we can provide a context that supports and facilitates various kinds of optional activities and helps to compensate for resource losses that may limit optional pursuits, older adults would be free to determine which kind of activity they want to engage in and what they do not want to do. Those “age-friendly environments” (Kruse, 1994) may include, for instance, improved public transportation systems, more leisure opportunities that are tailored to older people, opportunities for social contacts that allow expression of generative concern, or new technologies that facilitate household chores. With the current worldwide increase in the population of old and very old people (e.g., World Health Organization, 2001), we can expect that future environments will be more and more adapted to the needs and preferences of older people. In conclusion, societies can assist older adults—at least those older adults who are not very frail—in finding their own ways of successful aging and engaging with life in positive ways by providing adequate contexts. In this realm, optional personal life investment may be one way of “adding life to years, not just more years to life” (first motto of the Gerontological Society of America in 1955 as cited in P. B. Baltes & Baltes, 1990, p. 5).
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APPENDICES

Appendix A
Appendix to Methods Section
Appendix A1
Descriptive Statistics of Study Variables and Overview of Variable Transformations

<table>
<thead>
<tr>
<th>Variable</th>
<th>$N$</th>
<th>Descriptive statistics prior to transformation</th>
<th>Transformations$^a$</th>
<th>Descriptive statistics after transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$M$ ($SD$)</td>
<td>Skewness ($SE$)</td>
<td>Kurtosis ($SE$)</td>
</tr>
<tr>
<td><strong>Personal Life Investment (POMP)</strong></td>
<td></td>
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<tr>
<td>Average PLI T1</td>
<td>511</td>
<td>52.7 (14.4)</td>
<td>-0.43 (0.11)</td>
<td>0.62 (0.22)</td>
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<td>Average PLI T3</td>
<td>202</td>
<td>53.6 (12.8)</td>
<td>-0.45 (0.17)</td>
<td>1.53 (0.34)</td>
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<tr>
<td>Average PLI T4</td>
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<td>54.6 (14.1)</td>
<td>-0.52 (0.21)</td>
<td>1.76 (0.42)</td>
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<td>Average PLI T5</td>
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<td>56.5 (13.5)</td>
<td>-0.31 (0.27)</td>
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<td>PLI selectivity T1</td>
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<td>27.8 (7.4)</td>
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<td>Obligatory PLI T1</td>
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<td>Optional PLI T1</td>
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<td>Optional PLI T5</td>
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<td><strong>Personality dispositions T1 (POMP)</strong></td>
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<tr>
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<td>66.5 (18.0)</td>
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<td>0.94 (0.22)</td>
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Note. Data that were used in the analyses are highlighted in italics.

$^a$Univariate outliers were adjusted to the closest non-outlying value. The number of outliers and the resulting restricted range of values is given.
### Variable

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<th>511</th>
<th>6.8 (1.4)</th>
<th>-0.44 (0.11)</th>
<th>0.11 (0.22)</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>N hopes&lt;sup&gt;b&lt;/sup&gt;</td>
<td>511</td>
<td>2.3 (1.1)</td>
<td>0.90 (0.11)</td>
<td>2.47 (0.22)</td>
<td>6 [0 – 5]</td>
</tr>
<tr>
<td>N fears&lt;sup&gt;b&lt;/sup&gt;</td>
<td>511</td>
<td>2.1 (1.0)</td>
<td>0.27 (0.11)</td>
<td>0.95 (0.22)</td>
<td>1 [0 – 5]</td>
</tr>
<tr>
<td>N self-definitions in obligatory domains</td>
<td>511</td>
<td>4.3 (1.8)</td>
<td>0.07 (0.11)</td>
<td>-0.35 (0.22)</td>
<td>None</td>
</tr>
<tr>
<td>N self-definitions in optional domains</td>
<td>511</td>
<td>3.1 (1.7)</td>
<td>0.46 (0.11)</td>
<td>-0.03 (0.22)</td>
<td>None</td>
</tr>
<tr>
<td>N hopes in obligatory domains&lt;sup&gt;b&lt;/sup&gt;</td>
<td>511</td>
<td>1.4 (1.0)</td>
<td>0.56 (0.11)</td>
<td>0.73 (0.22)</td>
<td>2 [0 – 4]</td>
</tr>
<tr>
<td>N fears in obligatory domains&lt;sup&gt;b&lt;/sup&gt;</td>
<td>511</td>
<td>1.3 (1.0)</td>
<td>0.58 (0.11)</td>
<td>0.22 (0.22)</td>
<td>1 [0 – 4]</td>
</tr>
<tr>
<td>N hopes in optional domains&lt;sup&gt;b&lt;/sup&gt;</td>
<td>511</td>
<td>0.4 (0.6)</td>
<td>1.51 (0.11)</td>
<td>1.79 (0.22)</td>
<td>2 [0 – 2]</td>
</tr>
<tr>
<td>N fears in optional domains&lt;sup&gt;b&lt;/sup&gt;</td>
<td>511</td>
<td>0.1 (0.4)</td>
<td>2.81 (0.11)</td>
<td>7.59 (0.22)</td>
<td>5 [0 – 1]</td>
</tr>
</tbody>
</table>

### Activities T1

<table>
<thead>
<tr>
<th>Duration total activity (minutes)</th>
<th>495</th>
<th>964.1 (112.6)</th>
<th>-0.11 (0.11)</th>
<th>0.39 (0.22)</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>POMP obligatory activities</td>
<td>495</td>
<td>89.9 (12.2)</td>
<td>-1.80 (0.11)</td>
<td>3.50 (0.22)</td>
<td>2&lt;sup&gt;a&lt;/sup&gt;arcsine(sqrt x)</td>
</tr>
<tr>
<td>POMP optional activities</td>
<td>495</td>
<td>9.2 (11.5)</td>
<td>1.54 (0.11)</td>
<td>2.07 (0.22)</td>
<td>3 [46.2 – 100.0]</td>
</tr>
</tbody>
</table>

<sup>a</sup>X denotes the original variable. Univariate outliers were adjusted to the closest non-outlying value. The number of outliers and the resulting restricted range of values is given.

<sup>b</sup>Lower numbers were assigned only to extreme outliers (i.e., cases that are more than 3 times the interquartile range smaller than the 25<sup>th</sup> percentile or larger than the 75<sup>th</sup> percentile.)
### Subjective well-being (POMP)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Descriptive statistics prior to transformation</th>
<th>Transformations*</th>
<th>Descriptive statistics after transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$M$ ($SD$)</td>
<td>Skewness ($SE$)</td>
<td>Kurtosis ($SE$)</td>
</tr>
<tr>
<td>Life satisfaction T1</td>
<td>511</td>
<td>67.9 (24.0)</td>
<td>-0.55 (0.11)</td>
<td>-0.00 (0.22)</td>
</tr>
<tr>
<td>Life satisfaction T2</td>
<td>205</td>
<td>66.1 (24.3)</td>
<td>-0.94 (0.17)</td>
<td>0.74 (0.34)</td>
</tr>
<tr>
<td>Life satisfaction T3</td>
<td>206</td>
<td>63.7 (24.8)</td>
<td>-0.55 (0.17)</td>
<td>-0.05 (0.34)</td>
</tr>
<tr>
<td>Life satisfaction T4</td>
<td>158</td>
<td>61.4 (25.5)</td>
<td>-0.57 (0.19)</td>
<td>0.11 (0.38)</td>
</tr>
<tr>
<td>Aging satisfaction T1</td>
<td>511</td>
<td>61.0 (19.1)</td>
<td>-0.28 (0.11)</td>
<td>-0.33 (0.22)</td>
</tr>
<tr>
<td>Aging satisfaction T2</td>
<td>206</td>
<td>60.6 (17.0)</td>
<td>-0.23 (0.17)</td>
<td>-0.05 (0.34)</td>
</tr>
<tr>
<td>Aging satisfaction T3</td>
<td>206</td>
<td>58.5 (17.7)</td>
<td>-0.25 (0.17)</td>
<td>-0.34 (0.34)</td>
</tr>
<tr>
<td>Aging satisfaction T4</td>
<td>158</td>
<td>55.9 (15.8)</td>
<td>-0.03 (0.19)</td>
<td>-0.56 (0.38)</td>
</tr>
</tbody>
</table>

### Functional health (t-scores)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Descriptive statistics prior to transformation</th>
<th>Transformations*</th>
<th>Descriptive statistics after transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$M$ ($SD$)</td>
<td>Skewness ($SE$)</td>
<td>Kurtosis ($SE$)</td>
</tr>
<tr>
<td>Functional health T1</td>
<td>510</td>
<td>50.0 (6.8)</td>
<td>-0.40 (0.11)</td>
<td>0.09 (0.22)</td>
</tr>
<tr>
<td>Functional health T2</td>
<td>206</td>
<td>53.1 (5.7)</td>
<td>-0.83 (0.17)</td>
<td>1.12 (0.34)</td>
</tr>
<tr>
<td>Functional health T3</td>
<td>206</td>
<td>52.2 (6.2)</td>
<td>-0.76 (0.17)</td>
<td>0.93 (0.34)</td>
</tr>
<tr>
<td>Functional health T4</td>
<td>157</td>
<td>51.6 (6.6)</td>
<td>-1.03 (0.19)</td>
<td>1.09 (0.39)</td>
</tr>
</tbody>
</table>

*Note. Data that were used in the analyses are highlighted in italics.

*Univariate outliers were adjusted to the closest non-outlying value. The number of outliers and the resulting restricted range of values is given.*
Appendix A2
Personal Life Investment Schedule

[Trained research assistants read the following instructions to participants and wrote down the answers that the participants gave verbatim.]

WHAT YOU THINK ABOUT AND DO

The following questions concern the things and topics you think about or do something about in your everyday life. First, let’s get a little acquainted with this topic. Please remember the last few months. What were the things and topics you have thought about or you have done something about?

[Participant names a few things and topics]

You can think about something or do something because you want to achieve something or maintain something. How about the topic you have just talked about? You have thought about … or you have done something about … because …?

[Participant gives a reason]

Now, I will show you a number of topics or things that people in general can deal with. Let’s take, for instance, the first topic. Would you say that your health is something you think about or do something for because you want to stay healthy or become healthy again?

For your answer you can again use grades. Give a “1” if you very much think about or do something for your health. With a “5” you would state that you never think about your health or do something for it.

So, how about …

1. Your health:
   How much do you presently think about it or do something about it? _____

2. Your cognitive fitness (e.g., your memory):
   How much do you presently think about it or do something about it? _____

3. Your hobbies and other interests:
   How much do you presently think about it or do something about it? _____

4. The relationship with your friends and acquaintances:
   How much do you presently think about it or do something about it? _____

5. Your sexuality:
   How much do you presently think about it or do something about it? _____

6. The well-being of your family members:
   How much do you presently think about it or do something about it? _____

7. Your professional occupation or a similar occupation:
   How much do you presently think about it or do something about it? _____

8. Your independence:
   How much do you presently think about it or do something about it? _____

9. Thinking about your life:
   How much do you presently think about it or do something about it? _____

Now, I have a last question about …

10. Your death and dying:
    How much do you presently think about it or do something that is related to it? _____
Appendix A3

Confirmatory Factor Analyses and Tests for Factorial Invariance of the Two-Factor Model for Personal Life Investment

In the following, results on the factor structure underlying the ten PLI items are reported. The factor structure was investigated and tested for metric invariance across different age groups and measurement occasions. The main interest was to see whether the correlative pattern of the PLI items changes with increasing age. If invariance of the correlative pattern can be demonstrated, one can be fairly sure that the items do not change their meaning across time or age groups.

Three questions were answered (Table A3_1): (1) What is the best factor model for the cross-sectional PLI data \( (N = 511) \)? Or, more specifically, is a two-factor model (obligatory PLI and optional PLI) more appropriate than a one-factor model (only average PLI)? Like all other SEM models in this dissertation, the SEM models estimated here were based on all available data, that is, some incomplete data were present in the analyses. The general analysis strategy described in G5 (pp. 142 – 143) was also applied here. Three models were compared. A null model assuming that the PLI items are all uncorrelated served as a basis for comparisons. A one-factor model depicts average PLI as the general latent construct explaining the correlations between PLI items. Finally, a two-factor model represents the hypothesized model that differentiates between obligatory PLI and optional PLI (Figure A3_1). As can be seen in Table A3_1, the one-factor model fitted better than the null model. The two-factor model, however, showed an even better fit to the data than the one-factor model. Additional fit statistics for the two-factor model (Table A3_2) reveal an acceptable overall fit. The parameter estimates for the overall cross-sectional two-factor model are presented in Table A3_3.

(2) Is it possible to demonstrate metric invariance across different age groups in the cross-sectional sample \( (N = 511) \)? That is, are the factor loadings identical for participants in their seventies, eighties, and nineties and over? A multigroup CFA model was computed for the three age groups. Comparison of the metric invariant two-factor model with the configural invariant two-factor model revealed that the more relaxed configurally invariant model more closely conforms to the data. However, loosening the constraints on the factor loadings did not significantly improve the fit of the model to the data (Table A3_1). Therefore, the two-factor metric invariant model is considered as the best representation of the data. The factor loadings of the PLI items (Table A3_3) are identical for septuagenarians, octogenarians, and nonagenarians in the cross-sectional BASE sample. Again, the overall fit of this model is acceptable (Table A3_2).
Table A3_1

<table>
<thead>
<tr>
<th>Model</th>
<th>-2LL</th>
<th>N Par.</th>
<th>∆-2LL</th>
<th>∆N Par.</th>
<th>p</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best CFA model for cross-sectional PLI data (N = 511)?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Null</td>
<td>48,363.4</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td>48,403</td>
<td>48,488</td>
</tr>
<tr>
<td>One-factor: Average PLI</td>
<td>47,890.6</td>
<td>30</td>
<td>472.8</td>
<td>10</td>
<td>.00</td>
<td>47,951</td>
<td>48,078</td>
</tr>
<tr>
<td>Two-factor: Obligatory and optional PLI</td>
<td>47,854.8</td>
<td>31</td>
<td>35.8</td>
<td>1</td>
<td>.00</td>
<td>47,917</td>
<td>48,048</td>
</tr>
</tbody>
</table>

Metric invariance across age decades?
Cross-sectional multigroup CFA model for young old (under 80 years; n = 171), old (80 - under 90 years; n = 170), and very old (90 years and older; n = 170) participants

<table>
<thead>
<tr>
<th>Model</th>
<th>-2LL</th>
<th>N Par.</th>
<th>∆-2LL</th>
<th>∆N Par.</th>
<th>p</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-factor metric invariant</td>
<td>47,714.6</td>
<td>77</td>
<td></td>
<td></td>
<td></td>
<td>47,869</td>
<td>48,195</td>
</tr>
<tr>
<td>Two-factor configural invariant</td>
<td>47,697.8</td>
<td>93</td>
<td>16.8</td>
<td>16</td>
<td>.40</td>
<td>47,884</td>
<td>48,278</td>
</tr>
</tbody>
</table>

Metric invariance across time?
CFA model for longitudinal T1 (n = 206) and T5 (n = 81) data

<table>
<thead>
<tr>
<th>Model</th>
<th>-2LL</th>
<th>N Par.</th>
<th>∆-2LL</th>
<th>∆N Par.</th>
<th>p</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null model</td>
<td>26,597.0</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td>26,697</td>
<td>26,863</td>
</tr>
<tr>
<td>One-factor metric invariant</td>
<td>26,376.8</td>
<td>62</td>
<td>220.2</td>
<td>12</td>
<td>.00</td>
<td>26,501</td>
<td>26,707</td>
</tr>
<tr>
<td>Two-factor metric invariant</td>
<td>26,323.0</td>
<td>68</td>
<td>53.8</td>
<td>6</td>
<td>.00</td>
<td>26,459</td>
<td>26,685</td>
</tr>
<tr>
<td>Two-factor configural invariant</td>
<td>26,315.8</td>
<td>76</td>
<td>7.2</td>
<td>8</td>
<td>.52</td>
<td>26,468</td>
<td>26,721</td>
</tr>
</tbody>
</table>

Note. -2LL = -2 × log-likelihood of model; N Par. = Number of Parameters; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; CFA = Confirmatory Factor Analysis.

(3) Is it possible to demonstrate metric invariance across the first (T1) and the last (T5) measurement occasion in BASE? The longitudinal BASE sample (N = 206) was employed to compare the two-factor metric invariant model with three alternative models (cf. Eizenman et al., 1997). First, a null model was specified that does not include factors but merely allows corresponding items to correlate across time (i.e., health at T1 with health at T5, cognitive fitness at T1 with cognitive fitness at T5, and so on). This model tests the hypothesis that all of the variance in the data is item-specific and that there are no underlying factors. Second, a one-factor metric invariant model was again used to test whether average PLI is sufficient to account for the variance in the data. As the ten PLI items can be assumed to retain some item-specific variance, corresponding PLI items were allowed to correlate in every of the four estimated models. Finally, a configural invariant two-factor model was estimated. Model comparisons demonstrated that the metric invariant two-factor model once more turned out as the best representation of the data (Table A3_1) and showed an acceptable overall fit (Table A3_2). The parameter estimates for this model are given in Table A3_3.
Table A3.2
Fit Statistics for Best-Fitting Two-Factor Models

<table>
<thead>
<tr>
<th>Two-factor model for</th>
<th>df</th>
<th>$\chi^2$</th>
<th>p</th>
<th>CFI</th>
<th>TLI</th>
<th>RMSEA [90% CI]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall cross-sectional sample</td>
<td>34</td>
<td>142.8</td>
<td>.00</td>
<td>.82</td>
<td>.76</td>
<td>.08 [.07 – .09]</td>
</tr>
<tr>
<td>Three age groups cross-sectional sample (metric invariant)</td>
<td>118</td>
<td>218.5</td>
<td>.00</td>
<td>.83</td>
<td>.80</td>
<td>.07 [.06 – .09]</td>
</tr>
<tr>
<td>Two occasions longitudinal sample (metric invariant)</td>
<td>162</td>
<td>245.0</td>
<td>.00</td>
<td>.82</td>
<td>.78</td>
<td>.05 [.04 – .06]</td>
</tr>
</tbody>
</table>

*Note. CFI = Comparative Fit Index; TLI = Tucker Lewis Index or Non-Normed Fit Index; RMSEA = Root Mean Square Error of Approximation; CI = Confidence Interval.*

In sum, the two factors of obligatory PLI and optional PLI best accounted for the variance in the ten PLI items. The factor loadings of the PLI items thereby can be considered as equal across different age groups (i.e., between participants of different ages) and across different measurement occasions (i.e., within participants as they age). These analyses lend strong support to the conclusion that the PLI items do not change their meaning across different ages or cohorts in BASE.

![Two-factor model for PLI](image)

*Figure A3.1. Two-factor model for PLI. Numbers refer to the parameter estimates given in Table A3_3.*
### Table A3.3

**Parameter Estimates for Best-Fitting Two-Factor Models**

<table>
<thead>
<tr>
<th>Parameter estimate (Figure A3.1)</th>
<th>Overall cross-sectional sample</th>
<th>Three age groups cross-sectional sample (metric invariant)</th>
<th>Two occasions longitudinal sample (metric invariant)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young old (&lt; 80 years)</td>
<td>Old (80 – &lt; 90 years)</td>
<td>Very old (90+ years)</td>
</tr>
<tr>
<td>Factor loadings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.66 (.51)</td>
<td>0.62 (.48)</td>
<td>0.62 (.54)</td>
</tr>
<tr>
<td>2</td>
<td>0.77 (.55)</td>
<td>0.71 (.48)</td>
<td>0.71 (.57)</td>
</tr>
<tr>
<td>3</td>
<td>0.55 (.36)</td>
<td>0.52 (.29)</td>
<td>0.52 (.43)</td>
</tr>
<tr>
<td>4</td>
<td>0.85 (.50)</td>
<td>0.80 (.40)</td>
<td>0.80 (.54)</td>
</tr>
<tr>
<td>5</td>
<td>=1 (.67)</td>
<td>=1 (.62)</td>
<td>=1 (.76)</td>
</tr>
<tr>
<td>6</td>
<td>0.79 (.46)</td>
<td>0.81 (.44)</td>
<td>0.81 (.55)</td>
</tr>
<tr>
<td>7</td>
<td>=1 (.58)</td>
<td>=1 (.56)</td>
<td>=1 (.60)</td>
</tr>
<tr>
<td>8</td>
<td>0.62 (.44)</td>
<td>0.65 (.47)</td>
<td>0.65 (.46)</td>
</tr>
<tr>
<td>9</td>
<td>0.40 (.32)</td>
<td>0.34 (.21)</td>
<td>0.34 (.27)</td>
</tr>
<tr>
<td>10</td>
<td>0.77 (.45)</td>
<td>0.79 (.38)</td>
<td>0.79 (.46)</td>
</tr>
<tr>
<td>Variances obligatory and optional PLI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>342.5</td>
<td>235.1</td>
<td>458.2</td>
</tr>
<tr>
<td>32</td>
<td>330.1</td>
<td>221.0</td>
<td>330.5</td>
</tr>
<tr>
<td>Covariance</td>
<td>196.5 (.58)</td>
<td>84.2 (.37)</td>
<td>237.9 (.61)</td>
</tr>
<tr>
<td>Additional covariances in longitudinal model</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBL1 - OBL5</td>
<td>158.7 (.50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPT1 - OPT5</td>
<td>136.4 (.60)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OBL1 - OPT5</td>
<td>95.6 (.35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPT1 - OBL5</td>
<td>170.5 (.64)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health 1 - 5</td>
<td>27.4 (.06, ns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognition 1 - 5</td>
<td>50.9 (.09, ns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family 1 - 5</td>
<td>247.2 (.40)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independ. 1 - 5</td>
<td>182.4 (.18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life-Ref. 1 - 5</td>
<td>189.1 (.27)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death 1 - 5</td>
<td>478.0 (.61)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leisure 1 - 5</td>
<td>86.3 (.13, ns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends 1 - 5</td>
<td>109.5 (.21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexuality 1 - 5</td>
<td>197.8 (.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work 1 - 5</td>
<td>112.7 (.12, ns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Means for PLI items</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>72.1</td>
<td>73.4</td>
<td>73.1</td>
</tr>
<tr>
<td>12</td>
<td>64.5</td>
<td>64.9</td>
<td>66.6</td>
</tr>
<tr>
<td>13</td>
<td>70.7</td>
<td>73.8</td>
<td>71.8</td>
</tr>
<tr>
<td>14</td>
<td>49.7</td>
<td>51.9</td>
<td>52.0</td>
</tr>
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Note. OBL = Obligatory PLI; OPT = Optional PLI.

*Standardized estimates are given in parentheses.
## Appendix A4
Correspondence between PLI Domain Categories and Activity Categories as Observed in the Hornig (2003) Study

<table>
<thead>
<tr>
<th>PLI domain category</th>
<th>Corresponding activity categories (frequency for PLI domain, activity category, and total frequency of activity category)</th>
<th>Activity categories selected as indicative of PLI domain</th>
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<tbody>
<tr>
<td>Health</td>
<td>101 Sleeping (104) 33 Doing nothing (33) 27 Taking a walk (30) 17 (Medical) treatment (22) 12 Going to bed (12) 11 Health-related self-treatment (14) 8 Active and other transportation (68) 7 Reading (176) 6 Personal care (116) 5 Sports (10) 5 Arising (13) 5 Shopping (60) 3 Eating/drinking (320) 3 TV/Video (328) 2 Passive transportation (29) 1 Excursions (2) 1 Other leisure activities (14) 1 Other chores (24) 1 Talking (face-to-face) (45) 1 Needlework/handicraft (54) 1 Light household chores (239)</td>
<td>Sleeping  Doing nothing  Going to bed  (Medical) treatment  Health-related self-treatment  Taking a walk  Sports  Excursions</td>
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<tr>
<td>Cognitive fitness</td>
<td>308 TV/Video (328) 151 Reading (176) 35 Playing (51) 14 Talking (on the phone) (31) 13 Radio/tapes/records (17) 5 Writing (14) 3 Other chores (24) 3 Doing nothing (53) 2 Dealing with other official institutions (12) 2 Talking (face-to-face) (45) 2 Eating/drinking (320) 1 Dealing with authorities/institutions (4) 1 Cultural activities (5) 1 Religious activities (7) 1 Other leisure activities (14) 1 Visits (35) 1 Gardening (58) 1 Light household chores (239)</td>
<td>TV/Video  Radio/tapes/records  Reading  Writing  Talking on the phone  Playing  Cultural activities</td>
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</table>

*Note. Activities are printed in italics if at least 50% of all observed activities in this category were coded as relevant to the PLI domain.*
### Appendix A4 continued

<table>
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<th>PLI domain category</th>
<th>Corresponding activity categories (frequency for PLI domain, activity category, and total frequency of activity category)</th>
<th>Activity categories selected as indicative of PLI domain</th>
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</thead>
</table>
| **Family**          | 31 *Talking (face-to-face)* (45)  
                        31 *Eating/drinking* (320)  
                        24 *Visits* (35)  
                        10 Active and other transportation (68)  
                        8 *Helping family members* (8)  
                        8 *Talking (on the phone)* (31)  
                        7 Shopping (60)  
                        6 Light household chores (239)  
                        4 *Other social contacts* (7)  
                        4 *Passive transportation* (29)  
                        4 *Doing nothing* (53)  
                        2 Other chores (24)  
                        2 *Taking a walk* (30)  
                        2 *Playing* (51)  
                        2 *Gardening* (58)  
                        1 Cultural activities (5)  
                        1 *Sports* (10)  
                        1 *Writing* (14)  
                        1 *(Medical) treatment* (22)  
                        1 Needlework/handicraft (54)  
                        1 *Reading* (176)  
                        1 *TV/Video* (328)  
                        *None* |                                                         |
| **Independence**    | 273 *Eating/drinking* (320)  
                        225 *Light household chores* (239)  
                        105 *Personal care* (116)  
                        47 Shopping (60)  
                        36 Active and other transportation (68)  
                        35 Needlework/handicraft (54)  
                        21 *Passive transportation* (29)  
                        15 Gardening (58)  
                        14 *Heavy household chores* (14)  
                        13 *Other chores* (24)  
                        8 *Arising* (13)  
                        7 *Doing nothing* (53)  
                        6 *Dealing with the post office* (8)  
                        4 *Dealing with other official institutions* (12)  
                        4 *(Medical) treatment* (22)  
                        3 *Planning* (3)  
                        3 *Dealing with authorities/institutions* (4)  
                        3 Sleeping (104)  
                        3 *Reading* (176)  
                        3 *TV/Video* (328)  
                        2 *Banking* (2)  
                        2 *Helping other persons* (4)  
                        2 *Talking (face-to-face)* (45)  
                        2 *Playing* (51)  
                        1 *Other self-care activities* (1)  
                        1 Cultural activities (5)  
                        1 Political activities/community service (6)  
                        1 *Sports* (10)  
                        1 *Health-related self-treatment* (14)  
                        1 Other leisure activities (14)  
                        *Eating/drinking*  
                        *Personal care*  
                        *Other self-care activities*  
                        *Arising*  
                        *Passive transportation*  
                        *Active and other transportation*  
                        *Light household chores*  
                        *Shopping*  
                        *Gardening*  
                        *Other chores*  
                        *Needlework/handicraft*  
                        *Dealing with the post office*  
                        *Banking*  
                        *Helping other persons*  
                        *Cultural activities* |

*Note.* Activities are printed in italics if at least 50% of all observed activities in this category were coded as relevant to the PLI domain.
### Appendix A4 continued

<table>
<thead>
<tr>
<th>PLI domain category</th>
<th>Corresponding activity categories (frequency for PLI domain, activity category, and total frequency of activity category)</th>
<th>Activity categories selected as indicative of PLI domain</th>
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<tbody>
<tr>
<td>Life reflection</td>
<td>5 Religious activities (7) 1 Writing (14) 1 Visits (35) 1 Reading (176) 1 Eating/drinking (320)</td>
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<tr>
<td>Death and dying</td>
<td>5 Religious activities (7) 3 Gardening (58) 4 Active and other transportation (68) 1 Talking (face-to-face) (45)</td>
<td>Religious activities*</td>
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<tr>
<td>Leisure</td>
<td>36 Gardening (58) 13 TV/Video (328) 12 Playing (31) 11 Reading (176) 9 Other leisure activities (14) 8 Needlework/handicraft (54) 5 Active and other transportation (68) 4 Education (4) 4 Creative activities (4) 4 Radio/tapes/records (17) 4 Other chores (24) 3 Sports (10) 2 Eating/drinking (320) 1 Excursions (2) 1 Cultural activities (5) 1 Health-related self-treatment (14) 1 Taking a walk (30) 1 Talking (on the phone) (31) 1 Doing nothing (53) 1 Shopping (60) 1 Personal care (116) 1 Light household chores (239)</td>
<td>Gardening  Sports  Excursions  Education  Creative activities  Needlework/handicraft  Playing  Cultural activities  Other leisure activities</td>
</tr>
<tr>
<td>Friends</td>
<td>9 Visits (35) 8 Talking (face-to-face) (45) 7 Talking (on the phone) (31) 7 Eating/drinking (319) 6 Writing (14) 5 Light household chores (239) 3 Other social contacts (7) 2 Helping other persons (4) 2 Other leisure activities (14) 2 Active and other transportation (68) 2 Personal care (116) 1 Cultural activities (5) 1 Religious activities (7) 1 Dealing with the post office (8) 1 Doing nothing (53) 1 Reading (176)</td>
<td>None</td>
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*Note.* Activities are printed in italics if at least 50% of all observed activities in this category were coded as relevant to the PLI domain.

*Religious activities were viewed as equally relevant to life reflection and death and dying. Hence, both PLI domain categories were considered as first and most important coding.*
### Appendix A4 continued

<table>
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<th>PLI domain category</th>
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<td><strong>Sexuality</strong></td>
<td>No relevant activities reported</td>
<td>None</td>
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| **Work**            | 9 *Regular paid work* (9)  
9 *Other work* (9)  
8 Needlework/handicraft (54)  
5 *Political activities/community service* (6)  
3 Active and other transportation (68)  
1 Dealing with the post office (8)  
1 Dealing with other official institutions (12)  
1 Writing (14)  
1 Other chores (24)  
1 Passive transportation (29)  
1 Talking (on the phone) (31)  
1 Gardening (58)  
1 Personal care (116)  
1 Reading (176)  
1 Eating/drinking (319) | Regular paid work  
Other work  
Political activities/community service |

*Note*. Activities are printed in italics if at least 50% of all observed activities in this category were coded as relevant to the PLI domain.
Appendix B
Appendix to Validation of Personal Life Investment
## Appendix B1

### Variable Intercorrelations

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*Note. Ns range between 484 and 511.*

*Dichotomous variable (0 = no; 1 = yes).*

*p < .05, **p < .01, ***p < .001.*
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<td>Number hopes optional domains</td>
<td>.00</td>
<td>.04</td>
<td>-.15**</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Fears optional domains</td>
<td>-.04</td>
<td>.02</td>
<td>.04</td>
<td>-.10*</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Duration total activity</td>
<td>-.01</td>
<td>.09*</td>
<td>.02</td>
<td>.07</td>
<td>.10*</td>
<td>-.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Obligatory activity</td>
<td>-.02</td>
<td>-.03</td>
<td>-.01</td>
<td>-.01</td>
<td>-.09*</td>
<td>-.01</td>
<td>.06</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Optional activity</td>
<td>-.07</td>
<td>.19***</td>
<td>.04</td>
<td>.09</td>
<td>.08</td>
<td>.05</td>
<td>.25***</td>
<td>-16***</td>
</tr>
<tr>
<td>23</td>
<td>Age</td>
<td>.13**</td>
<td>-.16***</td>
<td>-.03</td>
<td>-.11*</td>
<td>-.11*</td>
<td>-.25***</td>
<td>.11*</td>
<td>-.29***</td>
</tr>
</tbody>
</table>

Note. Ns range between 484 and 511.
*Dichotomous variable (0 = no; 1 = yes).
*p < .05. **p < .01. ***p < .001.
# Appendix B2

## Results of Commonality Analyses

### Table B2_1

*Commonality Analysis for Obligatory PLI: Unique and Shared Portions of Predictive Variance of Personality Dispositions and Self-Concept Variables*

<table>
<thead>
<tr>
<th>Variables</th>
<th>ΔR² per step</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Step 1: P</td>
<td>Step 2: SC</td>
<td>Step 1: SC</td>
</tr>
<tr>
<td>Obligatory PLI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(N = 507)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personality (P):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extraversion, positive affectivity, neuroticism, negative affectivity, openness, internal control</td>
<td>1: .237***</td>
<td>1: .031**</td>
<td></td>
</tr>
<tr>
<td>Self-concept (SC):</td>
<td></td>
<td>1: .017*</td>
<td>2: .223***</td>
</tr>
<tr>
<td>Number self-defining domains, number hopes obligatory domains, number fears obligatory domains</td>
<td>2: .017*</td>
<td>2: .223***</td>
<td>1: .031**</td>
</tr>
</tbody>
</table>

+p < .10. *p < .05. **p < .01. ***p < .001.

### Table B2_2

*Commonality Analyses for Average PLI and Optional PLI: Unique and Shared Portions of Predictive Variance of Personality Dispositions, Self-Concept Variables, and Activities*

<table>
<thead>
<tr>
<th>Variables</th>
<th>ΔR² per step</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Average PLI</td>
<td></td>
<td>1: .286*** 1: .286***</td>
<td>1: .031*** 1: .031***</td>
</tr>
<tr>
<td>(N = 493)</td>
<td></td>
<td>2: .012* 2: .001</td>
<td>2: .008* 2: .008*</td>
</tr>
<tr>
<td>Extraversion, positive affectivity, neuroticism, negative affectivity, openness, internal control</td>
<td>1: .286***</td>
<td>2: .012*</td>
<td>3: .000</td>
</tr>
<tr>
<td>Self-concept (SC):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number hopes, number fears</td>
<td>1: .286***</td>
<td>2: .012*</td>
<td>3: .000</td>
</tr>
<tr>
<td>Activity (A):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration total activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optional PLI</td>
<td></td>
<td>1: .188*** 1: .188***</td>
<td>1: .028** 1: .028**</td>
</tr>
<tr>
<td>(N = 494)</td>
<td></td>
<td>2: .015* 2: .026*** 2: .045***</td>
<td>2: .175** 2: .175**</td>
</tr>
<tr>
<td>Extraversion, positive affectivity, openness</td>
<td>1: .188***</td>
<td>2: .015*</td>
<td>3: .019**</td>
</tr>
<tr>
<td>Self-concept (SC):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number hopes, number self-definitions optional domains</td>
<td>2: .026***</td>
<td>3: .007</td>
<td>3: .148***</td>
</tr>
<tr>
<td>Activity (A):</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration total activity, optional activity</td>
<td>2: .045***</td>
<td>3: .148***</td>
<td>1: .062***</td>
</tr>
</tbody>
</table>

+p < .10. *p < .05. **p < .01. ***p < .001.
Appendix B3
Validation of Personal Life Investment in the Longitudinal BASE Sample

Table B3_1
Correlations between PLI Facets, Personality Dispositions, Current and Possible Selves, and Activities at T1 (Longitudinal Sample)

<table>
<thead>
<tr>
<th>PLI</th>
<th>Average</th>
<th>Selectivity</th>
<th>Obligatory</th>
<th>Optional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extraversion</td>
<td>.26***</td>
<td>-.10</td>
<td>.13+</td>
<td>.31***</td>
</tr>
<tr>
<td>Positive affect</td>
<td>.42***</td>
<td>-.09</td>
<td>.29***</td>
<td>.35***</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>.04</td>
<td>.07</td>
<td>.17*</td>
<td>-.14*</td>
</tr>
<tr>
<td>Negative affect</td>
<td>.20**</td>
<td>.09</td>
<td>.33***</td>
<td>-.08</td>
</tr>
<tr>
<td>Openness</td>
<td>.32***</td>
<td>.00</td>
<td>.28***</td>
<td>.18**</td>
</tr>
<tr>
<td>Internal control</td>
<td>.22**</td>
<td>-.04</td>
<td>.18**</td>
<td>.18*</td>
</tr>
<tr>
<td>Number self-defining domains</td>
<td>.05</td>
<td>.10</td>
<td>.09</td>
<td>-.04</td>
</tr>
<tr>
<td>Number hopes</td>
<td>.18*</td>
<td>-.05</td>
<td>.12+</td>
<td>.13+</td>
</tr>
<tr>
<td>Number fears</td>
<td>.16*</td>
<td>.08</td>
<td>.15*</td>
<td>.07</td>
</tr>
<tr>
<td>Number selfDefinitions</td>
<td>-.03</td>
<td>-.06</td>
<td>.07</td>
<td>-.17*</td>
</tr>
<tr>
<td>Number selfDefinitions</td>
<td>.00</td>
<td>.04</td>
<td>-.08</td>
<td>.14*</td>
</tr>
<tr>
<td>Number hopes obligatory domains</td>
<td>.18*</td>
<td>-.04</td>
<td>.16*</td>
<td>.09</td>
</tr>
<tr>
<td>Number fears obligatory domains</td>
<td>.06</td>
<td>.04</td>
<td>.07</td>
<td>.01</td>
</tr>
<tr>
<td>Number hopes optional domains</td>
<td>-.09</td>
<td>.05</td>
<td>-.09</td>
<td>-.04</td>
</tr>
<tr>
<td>Fears optional domains</td>
<td>-.03</td>
<td>.00</td>
<td>-.10</td>
<td>.08</td>
</tr>
<tr>
<td>Duration total activity</td>
<td>-.01</td>
<td>-.06</td>
<td>-.03</td>
<td>.04</td>
</tr>
<tr>
<td>Obligatory activity</td>
<td>-.05</td>
<td>.03</td>
<td>.04</td>
<td>-.14*</td>
</tr>
<tr>
<td>Optional activity</td>
<td>.10</td>
<td>.00</td>
<td>.03</td>
<td>.16*</td>
</tr>
<tr>
<td>Age</td>
<td>-.11</td>
<td>.15*</td>
<td>-.02</td>
<td>-.18*</td>
</tr>
</tbody>
</table>

Note. Ns range between 200 and 206. Correlations between corresponding variables are printed in bold.
* Dichotomous variable (0 = no; 1 = yes).
+ p < .10, * p < .05, ** p < .01, *** p < .001.
### Table B3_2
Regression Analyses with the Longitudinal Sample: Predicting Average PLI, Obligatory PLI, and Optional PLI by Personality Dispositions, Current and Possible Selves, and Activities

<table>
<thead>
<tr>
<th></th>
<th>Average PLI (N = 205)</th>
<th>Obligatory PLI (N = 206)</th>
<th>Optional PLI (N = 205)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>$B$</td>
<td>$\Delta R^2$</td>
</tr>
<tr>
<td>Extraversion</td>
<td>.06</td>
<td>.06</td>
<td>.00</td>
</tr>
<tr>
<td>Positive affect</td>
<td>.24**</td>
<td>.23</td>
<td>.04</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>-.18*</td>
<td>-.12</td>
<td>.02</td>
</tr>
<tr>
<td>Negative affect</td>
<td>.32***</td>
<td>.28</td>
<td>.05</td>
</tr>
<tr>
<td>Openness</td>
<td>.18*</td>
<td>.17</td>
<td>.03</td>
</tr>
<tr>
<td>Internal control</td>
<td>.14*</td>
<td>.11</td>
<td>.02</td>
</tr>
<tr>
<td>Number self-defining domains</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number hopes</td>
<td>.09</td>
<td>1.07</td>
<td>.01</td>
</tr>
<tr>
<td>Number fears</td>
<td>.10</td>
<td>1.39</td>
<td>.01</td>
</tr>
<tr>
<td>Number facet-specific self-definitions</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number facet-specific hopes</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Number facet-specific fears</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Duration total activity</td>
<td>-.04</td>
<td>-.01</td>
<td>.00</td>
</tr>
<tr>
<td>Facet-specific activity</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

**Note.** All tolerances are above .50. $\Delta R^2$ gives the unique variance explained by this variable. Dashed lines indicate that variables were not included, either because of nonsignificant zero-order correlations or to avoid multicollinearity.

*As number of hopes/fears and number of hopes/fears in obligatory domains are highly correlated ($r > .60$), number of hopes/fears were not included in the analysis to avoid multicollinearity.

+$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$. 

Appendix B3
Appendix C
Appendix to Development and Dynamics of Personal Life Investment
Appendix C1

Testing for Differences in Developmental Trajectories between the Combined T3/T4 and T5 Longitudinal Samples

All LDS models across time-in-study were computed with the entire longitudinal sample (T3, T4, and T5 participants). By analyzing participants with two, three, and four PLI occasions together, it is assumed that they can be described with the same change function. However, this assumption may not hold true and thus needs to be tested. In the following, the question of whether the participants of the T3 and T4 samples develop differentially or in a similar manner as participants of the T5 sample (i.e., those who were observed at all measurement occasions) is addressed.

The identified best-fitting LDS models for average PLI, PLI selectivity, obligatory PLI, and optional PLI (cf. section H2c) were again estimated, this time separately for the combined T3 and T4 samples and for the T5 sample. To test for sample differences in trajectories, the log-likelihood (-2LL) for the entire longitudinal sample (N = 206) is compared to the log-likelihoods that have been obtained separately for the T3/T4 sample (n = 125) and T5 sample (n = 81). Here,

\[-2LL_{\text{longitudinal sample}} - (-2LL_{\text{T3/T4 sample}} + -2LL_{\text{T5 sample}})\]

is \(\chi^2\)-distributed with degrees of freedom equal to the number of parameters that are estimated in the LDS model (cf. Ghisletta & McArdle, 2001; McArdle & Hamagami, 1996).\(^{19}\) A significant difference between the -2LL value when the T3/T4 and T5 samples are combined and the sum of the -2LL values that are obtained when parameters are estimated separately for the T3/T4 sample and T5 sample indicates that the T3/T4 sample and T5 sample show different trajectories. This would mean that the samples cannot be reasonably combined in one overarching model.

When analyses were conducted with the T3/T4 and T5 samples separately, the parameter estimates from the LDS models for average PLI, \(\chi^2(5) = 4.2, p = .52\), obligatory PLI, \(\chi^2(6) = 2.9, p = .82\), and optional PLI, \(\chi^2(7) = 10.6, p = .16\), did not differ significantly from the results that had been obtained with the combined longitudinal sample. A significant difference was obtained for PLI selectivity, \(\chi^2(5) = 11.6, p < .05\). However, this difference can be attributed to a greater unique or error variance in the T3/T4 sample (SD = 5.5) compared to the T5 sample (SD = 4.6). Once the error variance was constrained equal across all analyses, parameter estimates did not differ between the combined versus separate analyses any more, \(\chi^2(4) = 7.0, p = .14\). Overall, the

\(^{19}\) This approach is equivalent to fitting a two-group model in which first all parameters are set equal across both groups, and then the constraints are relaxed to allow for group-specific parameter estimates (e.g., Loehlin, 1998; McArdle & Epstein, 1987).
size of means and standard deviations of initial levels and slopes of the four PLI facets can be considered equal in the T3/T4 and T5 samples.
Appendix C2

Fit Statistics for Different Bivariate Latent Difference Score Models Capturing the Dynamics between Obligatory PLI and Optional PLI

<table>
<thead>
<tr>
<th>Model</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2LL</td>
<td>N Par.</td>
</tr>
<tr>
<td>1: No association between univariate models</td>
<td>9,893.9</td>
</tr>
<tr>
<td>2: Correlated levels</td>
<td>9,868.3</td>
</tr>
<tr>
<td>3: Correlated levels and slopes</td>
<td>9,850.4</td>
</tr>
<tr>
<td>4: All possible correlations</td>
<td>9,849.7</td>
</tr>
</tbody>
</table>

Contemporaneous γ paths (Figure 11, p. 147)

<table>
<thead>
<tr>
<th>Model</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2LL</td>
<td>N Par.</td>
</tr>
<tr>
<td>5: Coupling from change obligatory to change optional</td>
<td>9,853.0</td>
</tr>
<tr>
<td>6: Coupling from change optional to change obligatory</td>
<td>9,858.1</td>
</tr>
<tr>
<td>7: Both couplings</td>
<td>9,852.7</td>
</tr>
</tbody>
</table>

Cross-lagged γ paths (Figure 10, p. 146)

<table>
<thead>
<tr>
<th>Model</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2LL</td>
<td>N Par.</td>
</tr>
<tr>
<td>8: Coupling from change obligatory to change optional</td>
<td>9,849.9</td>
</tr>
<tr>
<td>9: Coupling from change optional to change obligatory</td>
<td>9,850.0</td>
</tr>
<tr>
<td>10: Both couplings</td>
<td>9,849.7</td>
</tr>
</tbody>
</table>

Note. -2LL = -2 \times \text{log-likelihood of model}; N Par. = \text{Number of Parameters}; AIC = \text{Akaike Information Criterion}; BIC = \text{Bayesian Information Criterion}.
Appendix D
Appendix to Functional Role of Personal Life Investment
Appendix D1
Comparisons of Latent Difference Score Models for Variables Involved in Successful Aging Analyses: T1 to T4

Table D1_1
Repetition of Comparison of Different LDS Models for PLI Across Time-in-Study (T1 – T4)

<table>
<thead>
<tr>
<th>Model</th>
<th>Statistic</th>
<th>-2LL</th>
<th>N Par.</th>
<th>Δ-2LL</th>
<th>ΔN Par.</th>
<th>p</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average PLI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
<td></td>
<td>4,065.9</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>4,071.9</td>
<td>4,081.9</td>
</tr>
<tr>
<td>2: CCS without r</td>
<td></td>
<td>4,061.3</td>
<td>5</td>
<td>4.6</td>
<td>2</td>
<td>.10</td>
<td>4,071.3</td>
<td>4,087.9</td>
</tr>
<tr>
<td><strong>PLI Selectivity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
<td></td>
<td>3,471.3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3,477.3</td>
<td>3,487.2</td>
</tr>
<tr>
<td>2: CCS without r</td>
<td></td>
<td>3,461.5</td>
<td>5</td>
<td>9.8</td>
<td>2</td>
<td>.01</td>
<td>3,471.5</td>
<td>3,488.2</td>
</tr>
<tr>
<td><strong>Obligatory PLI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
<td></td>
<td>4,273.7</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>4,279.7</td>
<td>4,289.7</td>
</tr>
<tr>
<td>2: CCS</td>
<td></td>
<td>4,268.8</td>
<td>6</td>
<td>4.9</td>
<td>3</td>
<td>.18</td>
<td>4,280.8</td>
<td>4,300.8</td>
</tr>
<tr>
<td>3: QCS without SD QS and rs involving QS</td>
<td></td>
<td>4,371.2</td>
<td>7</td>
<td>0.1</td>
<td>1</td>
<td>1.00</td>
<td>4,385.2</td>
<td>4,408.5</td>
</tr>
<tr>
<td><strong>Optional PLI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: NCS</td>
<td></td>
<td>4,384.0</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>4,390.0</td>
<td>4,400.0</td>
</tr>
<tr>
<td>2: CCS</td>
<td></td>
<td>4,371.1</td>
<td>6</td>
<td>12.9</td>
<td>3</td>
<td>.01</td>
<td>4,383.1</td>
<td>4,403.0</td>
</tr>
<tr>
<td>3: QCS without SD QS and rs involving QS</td>
<td></td>
<td>4,371.2</td>
<td>7</td>
<td>0.1</td>
<td>1</td>
<td>1.00</td>
<td>4,385.2</td>
<td>4,408.5</td>
</tr>
</tbody>
</table>

Note. Best-fitting models are printed in italics. NCS = No Change Score; CCS = Constant Change Score; QCS = Quadratic Change Score; -2LL = -2 × log-likelihood of model; N Par. = Number of Parameters; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.
Table D1_2
Comparison of Different LDS Models for Functional Health, Life Satisfaction, and Aging Satisfaction Across Time-in-Study (T1 – T4)

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Model</th>
<th>-2LL</th>
<th>N Par.</th>
<th>Δ-2LL</th>
<th>ΔN Par.</th>
<th>p</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional Health</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1: NCS</td>
<td>4,151.5</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2: CCS without r</td>
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<td>4,052.3</td>
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<td>6</td>
<td>vs. 2: 0.5</td>
<td>1</td>
<td>.48</td>
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<td>4,057.2</td>
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<td>1</td>
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<td>8</td>
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<td>6</td>
<td>vs. 2: 3.8</td>
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<td>.05</td>
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<td>6,878.2</td>
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<td>vs. 2: 0.4</td>
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<td>1.00</td>
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<td>vs. 2: 6.0</td>
<td>4</td>
<td>.20</td>
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<td>6,862.1</td>
<td>4</td>
<td>vs. 2: 12.1</td>
<td>1</td>
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<td>6,870.1</td>
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<td>vs. 2: 3.5</td>
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<td><strong>Aging Satisfaction</strong></td>
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<td>6,264.8</td>
<td>5</td>
<td>vs. 1: 84.4</td>
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<td>6,291.4</td>
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<td>3: CCS</td>
<td>6,254.9</td>
<td>6</td>
<td>vs. 2: 9.9</td>
<td>1</td>
<td>.00</td>
<td>6,266.9</td>
<td>6,286.9</td>
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<td>4: QCS without SD QS and r involving QS</td>
<td>6,254.7</td>
<td>7</td>
<td>vs. 3: 0.2</td>
<td>1</td>
<td>.66</td>
<td>6,268.7</td>
<td>6,292.0</td>
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<td>6,252.5</td>
<td>9</td>
<td>vs. 3: 2.4</td>
<td>3</td>
<td>.49</td>
<td>6,270.5</td>
<td>6,300.4</td>
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<td>4</td>
<td>vs. 3: 13.9</td>
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<td>7: DCS</td>
<td>6,254.4</td>
<td>7</td>
<td>vs. 3: 0.5</td>
<td>1</td>
<td>.48</td>
<td>6,268.4</td>
<td>6,291.7</td>
</tr>
</tbody>
</table>

*Note.* Best-fitting models are printed in italics. NCS = No Change Score; CCS = Constant Change Score; QCS = Quadratic Change Score; LCS = Latent Change Score; PCS = Proportional Change Score; DCS = Dual Change Score; -2LL = -2 × log-likelihood of model; N Par. = Number of Parameters; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.
The regression analyses reported in H3 were repeated with the entire cross-sectional sample to allow for a direct comparison of results between the two samples (Table D2_1). The most obvious difference probably lies in the differential amounts of explained variance. The higher amount of explained variance in the longitudinal sample is in part due to the use of more reliable variables. The level variables that were estimated with the LDS models contain less error variance. This also explains why some associations that have been found with the longitudinal sample are smaller or not significant in the larger cross-sectional sample.

As can be seen in Table D2_1, the pattern of findings was largely unchanged in the cross-sectional sample when compared to the longitudinal sample. Some interactions that had been found with the longitudinal sample failed to reach significance in the cross-sectional sample. In the regression with life satisfaction as the dependent variable, the interaction between functional

### Table D2_1

<table>
<thead>
<tr>
<th>Effect</th>
<th>Steps Life Satisfaction</th>
<th>Steps Aging Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 β</td>
<td>1 B</td>
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<tr>
<td>Average PLI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Functional health (FH)</td>
<td>.24***</td>
<td>.091***</td>
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<tr>
<td>2 FH × AP</td>
<td>.02</td>
<td>0.03</td>
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<tr>
<td>ΔR²</td>
<td>.06***</td>
<td>0.00</td>
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<tr>
<td>R²</td>
<td>.06***</td>
<td>0.06***</td>
</tr>
<tr>
<td>PLI Selectivity</td>
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<td></td>
</tr>
<tr>
<td>1 Functional health (FH)</td>
<td>.23***</td>
<td>.87***</td>
</tr>
<tr>
<td>2 FH × PS</td>
<td>.00</td>
<td>0.00</td>
</tr>
<tr>
<td>ΔR²</td>
<td>.05***</td>
<td>0.00</td>
</tr>
<tr>
<td>R²</td>
<td>.05***</td>
<td>0.05***</td>
</tr>
<tr>
<td>Obligatory PLI and Optional PLI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Functional health (FH)</td>
<td>.20***</td>
<td>.76***</td>
</tr>
<tr>
<td>Obligatory PLI (OB)</td>
<td>-.11*</td>
<td>-.15*</td>
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<tr>
<td>Optional PLI (OP)</td>
<td>.16**</td>
<td>.21**</td>
</tr>
<tr>
<td>2 FH × OB</td>
<td>.00</td>
<td>0.04</td>
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<tr>
<td>2 FH × OP</td>
<td>.06</td>
<td>1.51</td>
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<tr>
<td>OB × OP</td>
<td>.04</td>
<td>0.87</td>
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<tr>
<td>ΔR²</td>
<td>.08***</td>
<td>0.01</td>
</tr>
<tr>
<td>R²</td>
<td>.08***</td>
<td>0.09***</td>
</tr>
</tbody>
</table>

**Note.** All tolerances are above .75.  
+p < .10. *p < .05. **p < .01. ***p < .001.
health and average PLI was not significant any more. Moreover, interactive effects of optional PLI and functional health on aging satisfaction but not on life satisfaction are found in the entire cross-sectional sample. Thus, the moderating function of PLI is again supported here, but associations were somewhat smaller due to the use of less reliable variables.

Still, the comparison of results from the longitudinal and cross-sectional sample also yields two interesting differences. First, obligatory PLI was negatively associated with satisfaction, indicating lower satisfaction in people who invested more in obligatory PLI domains (Table D2_1). Second, there was no indication of an interaction between obligatory PLI and optional PLI. These differences may be attributable to the smaller size of the longitudinal sample or the use of more reliable indicators when estimated PLI levels instead of T1 PLI data are employed. However, there may also be genuine differences between the samples. To investigate this possibility, a grouping variable was created in the cross-sectional sample: Participants with only one measurement occasion received the code 0 and participants with more than one measurement occasion received the code 1. This new dummy variable and all possible two-way and three-way interactions with the variable were included together with the original predictors in an additional regression analysis with the cross-sectional sample. The regression with life satisfaction as the dependent variable yielded only one significant effect involving the new grouping variable: a triple interaction between obligatory PLI, optional PLI, and the grouping variable, $\beta = .12, p < .05$. The same triple interaction became significant in the regression with aging satisfaction as the dependent variable, $\beta = .11, p < .05$. The interaction between obligatory and optional PLI was unique to those participants who became part of the longitudinal sample. For those participants, obligatory PLI was negatively related to satisfaction only if optional PLI was simultaneously very low. For the participants who dropped out of BASE after T1, obligatory PLI was negatively related to satisfaction and did not interact with optional PLI.

In contrast to the interaction between obligatory and optional PLI, the interaction between functional health and optional PLI can be considered as characteristic of both samples. No significant triple interactions with the grouping variable were obtained (life satisfaction: $\beta = .02, p = .80$; aging satisfaction: $\beta = .00, p = 1.0$). Optional PLI tended to moderate the relationship between health and satisfaction in both samples.
Versicherung

Hiermit versichere ich, dass ich die vorliegende Arbeit ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe; die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sind als solche kenntlich gemacht. Die Arbeit wurde bisher weder im Inland noch im Ausland in gleicher oder ähnlicher Form einer anderen Prüfungsbehörde vorgelegt.

__________________________
Dipl.Psych. Ines Schindler