The Adaptive Self

Personal Continuity and Intentional Self-Development
The Adaptive Self
To Jochen Brandtstädter
The Adaptive Self
Personal Continuity and Intentional Self-Development

Edited by

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We partly are and we partly become who we want to be. Explaining this astonishing congruence between actual and ideal conceptions of ourselves and of our development is the underlying goal of an action perspective on psychology (Brandtstädter, 1984, 1998). For some decades now, theories of life-long development have been inspired by the idea that development can be understood as the result of intentional action. From this perspective, individuals are regarded as “producers of their development” (Lerner & Busch-Rossnagel, 1981). Investigation of the processes relating
to the selection of personal goals and their translation to personal action has advanced our understanding of the conditions that are necessary for successful development as well as the conditions that might interfere with the efficient pursuit of goals (Brandtstädter & Lerner, 1999; Heckhausen & Dweck, 1998).

Focusing exclusively on the active part of intentional self-development, however, does not provide a comprehensive account of development across the life-span: Typically, personal life histories are interspersed with failures and undesirable life events that were not intended by the individual and cannot be undone by active or compensatory efforts (Filipp, 1995; Montada, Filipp, & Lerner, 1992). Integrating the role of unintended events and adversities in personal development into a coherent theoretical framework requires some kind of dialectical maneuver on the part of an action perspective on human development. To fully capture the interdependence between “is” and “ought” in human development, one has to acknowledge that not only do we become who we want to be, but also that we want to be who we are and have become. A central objective of Jochen Brandtstädter’s variant of an action perspective on development has been to elucidate the processes and mechanisms that allow personal goals, aspirations, and evaluations to be adapted to a given developmental situation in this way (Brandtstädter, 1989, 1998, 2001; Brandtstädter & Greve, 1994; Brandtstädter & Renner, 1990, 1992; Brandtstädter & Rothermund, 2002a, b; Brandtstädter, Rothermund, & Schmitz, 1998; Brandtstädter, Wentura, & Greve, 1993; Brandtstädter, Wentura & Rothermund, 1999).

The key terms describing the balance between being the producer of development and the product of contextual constraints are “adaptivity” and “the self.” Adaptivity is used to characterize individual adjustments to certain circumstances, problems, obstacles, or deficits that maintain or enhance the stability of (certain features of) the individual. The human mind is not only adapted to the challenges and demands of its environment, as Barkow, Cosmides, and Tooby (1992) have convincingly argued from an evolutionary perspective, it is also adaptive – that is, able to adapt to individually occurring situations and experiences.

The self, or the complex system constituting this adaptive capacity, should not be understood as representing one central unit, but rather as a collection of very diverse processes, mechanisms, and structures. Clearly, then, the self serves several functions. First, it processes and integrates a huge amount of information that relates to the individual in one way or another (including moods, intuitions, and other internal states). Second, the outcome of these processes – the individual self-concept – forms the basis for behavior, in particular intentional actions (Brandtstädter, 1998, 1999; Lerner, Theokas, & Jelicic, this volume). In order to serve this function, the various forms of information processing have to be sufficiently realistic (including knowledge of the individual’s own capacities and limitations) and, at the same time, sufficiently stabilizing, because one precondition for long-term planning is a knowledge base that extends into the future. Moreover, the self has to enable the individual to set his or her own goals, since any action needs direction and thus presupposes decisions.
However, the self is not only the producer of individual action and hence of developmental processes (Brandtstädter, 1998). At the same time, it is the product of development. After the emergence of its basic features, processes, and structures during the first years (which is not the focus of the present book; see, e.g., Harter, 1998), it must constantly adapt to changing circumstances and conditions (situational demands, varying environments and social partners, but also changing internal conditions, e.g., decline of sensory or cognitive capacities). Thus, the self is both the producer and the product of development (Brandtstädter & Lerner, 1999).

Moreover, inasmuch as some plans and actions are not only relevant for, but even intentionally directed towards the person’s own development, the self is the “co-producer” (Featherman & Lerner, 1985) of individual development in the narrower sense of this term. Everybody has plans, sometimes even complete scripts for their own development. Of course, more often than not, these plans are not fully fulfilled and may even fail completely, but the self reacts to obstacles and failures with new plans and scripts, sometimes with contingency plans prepared in advance. One central aim of these developmental plans and identity projects is personal continuity and stability. This continuity has to be achieved by means of adaptations, or changes, but even these changes serve the goal of continuity (Ryff, Singer, Love, & Essex, 1998). It is clear that we not only have a strong desire, but an existential need for a sense of identity, of being and staying the same person that we were yesterday and earlier on in life. Moreover, we need to be confident of remaining the same person tomorrow and the day after tomorrow. Adaptation in and to a permanently changing world requires changes in order to prevent more aversive changes. Thus, intentional self-development (Brandstädter, 1999) means producing the conditions of one’s own future – partly intentionally, partly as the result of circumstances – to make sure that it is possible to act and react, but, at the same time, to remain ourselves despite the many changes and adaptations necessary.

However, if “the self” is not a single information processing device or unit, but rather a very complex and dynamic system of interacting structures and processes (Markus & Wurf, 1987), it is far from clear how the notion of “identity,” of staying the same person throughout our lives can be preserved despite the many changes we experience within and around us. The present collection of papers attempts to find answers to this question. What constitutes and stabilizes personal continuity and thus identity? How can a sense of continuity be preserved while acknowledging the necessity of changes? How can the complex interplay of emotional, motivational, and cognitive processes be understood? How can defending identity and personal stability be reconciled with the need to be sufficiently realistic, even with respect to one’s own losses and declines? How is it possible to analyze the interplay between producing one’s own development and being produced by one’s own development? Is intentional self-development, that is development of the self and through the self, a mere metaphor, a façon de parler, or is it a key to understanding what development in general means and how it works?

The notion of the adaptive self discussed in this book brings together and connects theoretical and empirical arguments from three perspectives. First, and most
important, from a developmental psychological perspective it attempts to provide a framework that integrates an action-theoretical perspective on intentional self-development with a life-span perspective on the development of the self. The central purpose of the book is to advance our understanding of what constitutes and stabilizes personal continuity and thus identity across life-span development. Its main thesis is that personal continuity is secured by a combination of active attempts at regulating one’s development on the one hand and flexible adjustment of the self to unalterable changes in one’s social and physical environment and in one’s attributes (e.g., competencies, physical fitness, health, cognitive abilities, etc.) on the other.

Second, this perspective is combined with attempts to investigate individual processes and resources in coping with losses and threats and, in particular, life crises and turning points. Few attempts have yet been made to investigate individual coping processes from a developmental perspective beyond taking the developmental relevance of the coping task into account. Our main thesis here is that developmental processes can be seen as both the driving force behind individual adaptations to developmentally relevant tasks and threats, and the product of these adaptations.

Third, an explanation of the underlying processes that constitute and regulate adaptational change and personal development requires the integration of different theoretical and methodological approaches. Self-views and self-conceptions have to be taken into account in combination with cognitive and information-processing approaches in order to explain micro-processes of self-perception and self-understanding. As a consequence, various methodological approaches, such as cross-sectional, longitudinal, sequential, and experimental designs, as well as various methods of assessment, such as questionnaire studies, experiments, and interview studies have to be combined to understand the adaptive processes of self-development.

The present volume is divided into four parts. The first section (“Adaptation and plasticity: Perspectives on self-development and development of the self”) comprises four chapters investigating self-development from a general perspective. Ines Schindler and Ursula M. Staudinger discuss the dynamics and the interplay between the mechanics and pragmatics of life. This theoretical framework of a life-span perspective on human development is complemented by the developmental systems perspective presented by Richard M. Lerner, Christina Theokas, and Helena Jelicic. Applied to the sample case of juvenile development, their approach sets the stage for an actional perspective on development: self-development means that individuals are co-producers of their development. Werner Greve adds the reverse perspective to this picture: self-development also means development of the self – one central question here is how far this self-development can be seen as intentional. Finally, Alexander von Eye completes this general perspective by discussing methodological questions relating to an action perspective on development, which must take into account not only statistical, but also logical forms of prediction.

The second section (“Action perspectives on development: Control of development and development of control”) focuses on a crucial theme of action perspectives on development: control. The roots of the psychological concept of control beliefs are discussed by Günter Krampen. Its origins in Julian Rotter’s social learning theory...
and application to both developmental psychology and personality psychology clearly demonstrate that an action perspective (on human development) can – and perhaps must – be integrated into a personality frame of reference, thus treading a path already prepared by Ines Schindler’s and Ursula M. Staudinger’s discussion of personality development and Werner Greve’s claim of the convergence of self development and personality. All three approaches converge in that they contribute to the emerging picture of personal continuity as a product of intentional self-development. Michael Poulin, Claudia Maria Haase, and Jutta Heckhausen add a further perspective by discussing the model of primary and secondary control of development in contrast to – or in comparison with – the two-process model proposed by Brandtstädter (Brandtstädter & Rothermund, 2002b). In their view, primary and secondary control processes on the one hand and accommodative and assimilative self-regulations on the other (Brandtstädter, 1998) are, in many respects, overlapping constructs. A control perspective on human development and well-being is applied to a central problem of self-regulation in the next chapter. Aleksandra Luszczynska and Ralf Schwarzer discuss the role of self-efficacy in health self-regulation. This indicates that control and efficacy are essential resources not only for the regulation of development, but also more directly for individual quality of life.

The third section (“Self-regulation and development: Adaptive processes”) takes a closer look at the processes that secure the interplay of personal continuity and lifelong adaptation. Martin Pinquart, Rainer K. Silbereisen, and Margit Wiesner present results indicating that adolescents not only reduce, but also actively produce discrepancies between developmental states and goals, suggesting that intentional self-development may not be restricted to the reduction of is/ought differences. In a similar vein, Helene Fung, Cara Rice, and Laura L. Carstensen discuss proactive motivational changes in later adulthood and contrast them with reactive changes in personal goals. Alexandra M. Freund and Natalie C. Ebner focus on a developmental shift with respect to what might be called the meta-goal of intentional self-development. The need – and necessity – to compensate for losses increases with age, thus increasingly triggering intraindividual processes that help individuals to reach this goal. Their discussion brings together the theory of selection, optimization, and compensation (SOC; Baltes & Baltes, 1990) with Brandtstädter’s two-process model (Brandtstädter & Rothermund, 2002b), and advances the discussion begun in the first partition of the book, particularly in Ines Schindler’s and Ursula M. Staudinger’s contribution. The chapter by Dirk Wentura takes a look beyond the personal stance adopted in the previous chapters. He takes a social-cognitive perspective on the dynamics behind – or within – the adaptive processes of the two-process model as well as the SOC model. Empirical and theoretical arguments suggest that the personal stance toward developmental self-regulation has to be complemented (and perhaps substituted in part) by a sub-personal approach investigating these processes of self-development from a cognitive point of view. In a final chapter, Klaus Rothermund reviews evidence on the implications of age stereotypes for the self-concepts and well-being of elderly people. Although age stereotypes generally present a threat
to well-being and successful development in old age, there is evidence for protective mechanisms that shield the aging self against this negative influence.

According to Brandtstädter (1998, in press), an action-theoretical approach to human development has to take into account that development always occurs in social and cultural contexts. Thus, the fourth section of this volume (“Development in context: Interactional perspectives on development”) focuses on an interactional perspective on development that is necessary to understand the regulative processes governing human development. The first two chapters in this section focus on interactions within partnerships. Eva Wunderer and Klaus A. Schneewind discuss the role of implicit relationship theories and their contribution to marital well-being. Georg Felser presents results that shed light on the interplay between self-views and partner views and the implications of this complex interaction for life and marital satisfaction. Clemens Tesch-Römer broadens the perspective again: Do adaptive mechanisms differ between cultures? He presents data from a cross-cultural study that open up the discussion of whether processes of accommodation are universal or culture-specific. In either case, one consequence of an actional and interactional approach to self-development is the emergence of an interventional perspective on development that aims at optimizing processes of self-development. Following this line of reasoning, Horst Gräser presents a framework for developmental counseling. In the final chapter, Jürgen Straub, Barbara Zielke, and Hans Werbik extend the picture by bringing together two lines of argument that were touched upon in several of the previous chapters. First, the processes of individual identity production are complemented by the concept of narrative identity, that is, the construction of a coherent personal identity by narrative reconstruction of one’s biography. Second, the general notion of intentional self-development, the discussion of developmental and personal control, the balance between reactive and proactive motivational changes, the shift from primary to secondary control, from promoting gains to offsetting losses, and finally the subpersonal cognitive processes that “produce” these changes all inevitably touch on the central question of individual autonomy. Though the topic of personal autonomy is more controversial today than ever before, any action-theoretical approach to human development must present an answer to this fundamental question.

We partly are and we partly become who we want to be. Even if it were acceptable, this phrase has many and diverse connotations. The present volume discusses the adaptive processes and the dynamic interplay between the pursuit of personal (developmental) goals and the (developmental) adjustment of these goals to constraints, losses, or alterations in action and developmental resources from a broad range of perspectives (Brandtstädter, 1998; Brandtstädter & Rothermund, 2002b). Brandtstädter uses the terms assimilation and accommodation to describe the fundamental processes of pursuing and adjusting one’s goals. Although not all contributors to this volume share this terminology, they all essentially agree that this kind of dual-process perspective represents a useful and heuristically fruitful theoretical framework. We differ only in minor or major details as to where this starting point leads.
INTRODUCTION

REFERENCES


Part 1
Adaptation and Plasticity: Perspectives on Self-Development and the Development of the Self
In this chapter we are interested in investigating more closely the biological and cultural underpinnings of self and personality functioning across the life span. To do so, a theoretical model distinguishing the mechanics and pragmatics of life is introduced (Staudinger & Pasupathi, 2000). Assimilation and accommodation are identified as central developmental mechanisms within this model. Finally, exemplary empirical evidence on the development of the mechanics and pragmatics of life as relevant to the functioning of self and personality is reviewed.
Lifespan development can be conceptualized as the interaction between two inter-related components: The mechanics and the pragmatics of life. The dual-component model of the mechanics and pragmatics of life took the conception of the mechanics and pragmatics of intelligence that had been proposed to capture intellectual lifespan development as a starting point. However, the mechanics and pragmatics of life aim at understanding how biology, culture, and the person interact during the ontogenesis of psychological and not only cognitive functioning (Staudinger & Pasupathi, 2000).

The Mechanics of Life

The biology-based and content-poor mechanics of life can be understood as the “hardware” that provides the necessary basis for any development. They include physiological processes associated with the encoding and processing of information, with basic motivational tendencies (approach-avoidance), and with basic emotional reactions (positive, negative). Already at birth, individuals differ in the basic physiological makeup underlying perception, information-processing, motivational expression, or emotionality. Some infants are quicker in reacting to novel stimuli, are more active and approach-oriented, or less prone to negative emotional reactions. Even though these are very early differences in physiological functioning they should not be mistaken to exclusively reflect genetic differences. The basic mechanics of life, however, do not afford efficient psychological functioning unless the necessary “software,” that is, the culture-dependent and content-rich pragmatics of life, is acquired.

The Pragmatics of Life

Drawing on the mechanics of life, we accumulate declarative and procedural knowledge about the world and our self. The life pragmatics consist of those bodies of factual and procedural knowledge that help us to understand and control the world, identify and pursue personal goals, regulate our affective reactions, etc. The pragmatics of life are shaped by cultural contexts and individual choice. Life pragmatics comprise knowledge (i.e., knowing about world or self) and regulatory functions or skills (i.e., being able to produce desired and avoid undesirable outcomes). Both knowledge and regulatory functions or skills can refer to the “self” or the “world” (see Figure 1.1; Staudinger & Pasupathi, 2000). Of course, neither the domains of “world” and “self” nor the constructs of knowledge and regulatory behavior or cognition and self and personality are mutually exclusive. Rather, these distinctions serve heuristic purposes in helping to organize and integrate evidence from relatively
diverse areas of psychological functioning such as cognition, personality, self-concept, and self-regulation (see Figure 1.1). The focus of the current paper is on those constructs in bold face that belong to the domain of self and personality (for coverage of the cognitive domain see Baltes, Lindenberger, & Staudinger, 1998; Staudinger, Marsiske, & Baltes, 1995).

![Figure 1.1 Facets and Target Domains of Life Mechanics and Life Pragmatics with Established Constructs as Illustrations (adapted from Staudinger & Pasupathi, 2000). Constructs printed in bold are covered in the chapter.](image-url)
The Mechanics and Pragmatics of Life as Relevant to Self and Personality Development

With regard to cognitive development, the contribution of the mechanics and pragmatics of life as well as their dynamic interaction is much better understood (e.g., Baltes et al. 1998; Cabeza, 2002) than it is in terms of the development of self and personality. For instance, the developmental trajectories of the cognitive mechanics and pragmatics are well established at least as far as the behavioral level is concerned. And it has been shown that with increasing age the cognitive pragmatics help to compensate functional deficits in the mechanics (e.g., Salthouse, 1984; see also Baltes et al., 1998; Staudinger, et al., 1995). Do we expect to see similar developmental trajectories and a similar relationship between the mechanics and pragmatics of life relevant to the functioning of self and personality?

The mechanics of life as relevant to the functioning of self and personality. Focusing the discussion on self and personality turns our attention to relatively enduring interindividual differences in the life mechanics that contribute to interindividual differences in self-concepts, self-regulation, or personality. We will refer to those as the life mechanics relevant to the functioning of self and personality. With this conceptualization we do not imply that there are specific physiological functions or brain areas that are exclusively relevant to self and personality functioning and others that are exclusively relevant to cognitive functioning. In fact, there is only one body and brain that constitutes the mechanic basis underlying both personality and cognitive functioning. Thus, the mechanics of life contain complex interactions between the cellular, neural, endocrine, and immunological system, which in turn provide the basis for cognition, emotion, motivation, and action. On the level of physiological indicators, it is therefore impossible to clearly separate from each other all aspects of the mechanics underlying cognition, emotion, and motivation. For instance, heart rate acceleration can be observed during negative affective episodes, but also during mental arithmetic (cf. Baltissen, in press; Garwood, Engel, & Capriotti, 1982; Levenson, 2000). With regard to neuroanatomy there is evidence for specialized brain areas (e.g., the amygdala, prefrontal cortex) that contribute to the formation of both basic emotions and basic motivational tendencies (e.g., Davidson, Jackson, & Kalin, 2000). Emotion and motivation, however, cannot be further separated. The emotion of fear, for instance, is inextricably linked to avoidance motivation. Temperamental dimensions also tend to show substantial interrelations, reflecting an underlying affective-motivational system rather than separate qualities (cf. Rothbart & Bates, 1998). The life mechanics relevant to the functioning of self and personality, thus, refer to a unique configuration of elements of the life mechanics that contribute to interindividual differences in self and personality functioning. This configuration entails basic emotional and motivational tendencies, as well as cognitive processes.

The pragmatics of life as relevant to the functioning of self and personality. The pragmatics of self and personality encompass self-knowledge and self-regulatory competencies (see Figure 1.1). Knowledge about the self pertains to trait conceptions
of personality as well as to the self-concept. We define self and personality broadly to encompass all that we know about our behavior, past experiences, anticipated and idealized futures, needs and wishes, abilities, or weaknesses that characterize our selves. The concept of who we are and what we are like is closely related to how we pursue goals, evaluate our selves, or adjust our self-views or goals under threat. Thus, self-regulation constitutes the procedural part of our self-knowledge (cf. Staudinger & Pasupathi, 2000).

The life pragmatics as relevant to the functioning of self and personality constitute a multifaceted, multilevel, open, and dynamic self-system (cf. Baltes & Graf, 1996; Brandstätter, 1998; Hull, 2002; Staudinger, 1999b). This self-system consolidates personality traits, self-conceptions, self-regulatory processes, and the psychology of action (cf. Staudinger & Pasupathi, 2000). Two basic developmental principles help to understand that consolidation process. One is the orthogenetic principle (Werner, 1957; for self development see Elbogen, Carlo, & Spaulding, 2001; Harter, 1998), and the other is what we know about the acquisition of expertise (e.g., Anderson, 1987). Development of the self-system in that sense means hierarchization through differentiation, integration, and automatization. The growing self-knowledge base affords the development of a hierarchical knowledge structure and a gradual proceduralization, that is the development of strategies of how to manage self-knowledge. Step by step personality traits and stable core self-concepts are abstracted from behavior in concrete situations. As a consequence, we can maintain a certain self-conception even though a specific situation speaks against it. This dynamic between stability and change is further supported by a host of self-regulatory mechanisms that are involved when selecting and reinterpreting situations such that stability at the highest level of the self-system can be preserved (cf. Brandstätter & Greve, 1994; Greve, in press). Overall, our conceptualization is thus in line with the notion of a dynamic self-system that comprises the self both as product and process (cf. Herzog & Markus, 1999; Markus & Wurf, 1987), and also with social-cognitive views of personality (cf. Cervone & Shoda, 1999; Mischel & Shoda, 1995), where personality is conceptualized as “an integrated self system” (Bandura, 1999, p. 229).

The Dynamic Interaction of the Mechanics and Pragmatics of Life as Relevant to Self and Personality Functioning

The mechanics and pragmatics of life mutually influence each other (see Figure 1.1). Following Cattell’s (e.g., 1971) investment theory, we consider the life mechanics as the processual building blocks from which developmental progress in the life pragmatics can emerge (Staudinger & Pasupathi, 2000). At first sight, one may think that the pragmatics are constrained by the “underlying” mechanics, and to a certain degree that is true. But most genetic as well as recent brain research has demonstrated that the richness or poverty of the (factual and procedural) knowledge we accumulate feeds back into the life mechanics and indeed may even change them (genetic expression, brain structures; Kirkwood, 2003; Singer, 2003). Extremely
inhibited children, for instance, are able to gain control of their fearful behavior, changing not only their psychological state but also the underlying reactive sympathetic nervous system (Kagan, 1994; see also Kagan, 1998). This reciprocal interaction of mechanics and pragmatics emphasizes the limits of the hardware-software metaphor introduced earlier. We need to stress that the acquired “software” can change the underlying “hardware,” which is not the first association that comes to mind when we currently think about computers. Thus, our understanding of the investment theory in this context does not suggest that life pragmatics by any means can be reduced to or are fully determined by the life mechanics.

The lifespan conception of ontogenesis (e.g., Baltes et al., 1998; Brandstätter, 1998) as a product of the interaction between biology (i.e., life mechanics), culture, and purposeful attempts at regulating one’s development (i.e., life pragmatics) implies that it is impossible to clearly separate the mechanics from the pragmatics of life. Starting at conception, biology, culture, and the developing “person” interact. For instance, basic temperamental dimensions (i.e., mechanics) and personality characteristics (i.e., pragmatics) show predictive relations across the life span (e.g., Caspi & Silva, 1995). But we do not know yet how exactly the underlying mechanics play out in the development of traits. For instance, do changes in the life mechanics result in the age-related decrease in openness to experience (e.g., decay in the physiological basis of the approach system) or is it rather the result of years of experience (e.g., losing interest because I have seen it all before), that is, the life pragmatics? Despite the seemingly inextricable interaction, it may nevertheless be useful for heuristic purposes to distinguish between the mechanics and pragmatics as relevant to self-functioning and use this distinction to better understand the lifespan development of self and personality.

How do the life mechanics as relevant to the functioning of self and personality become invested during development to form the pragmatic side of the self-system? For this discussion, Block’s (1982) elaboration on the role of assimilation and accommodation that builds on Piaget (1967) as well as Werner’s (1957) orthogenetic principle is of interest. To recapture, assimilation can be viewed as the utilization of existing structures or schemes for the organization of experience and action. Accommodation refers to the formation of new and re-formation of old structures or schemes to process discrepant experience (Block, 1982). We begin life with some primitive assimilative structures (as part of our mechanics) that become ever more differentiated via accommodation to accumulating experience. In order to manage this increasing complexity, it is necessary to develop new integrating structures. This integration can be achieved by developing higher levels in the self-system hierarchy (Block, 1982). Higher levels within the self-system possess higher assimilative potential, i.e., they can integrate many different and highly situation-specific experiences. This, as stated above, allows us to establish a stable self-concept that is independent of momentary feedback. Following the adaptive imperative: “Assimilate if you can; accommodate if you must!” (Block, 1982, p. 286), the highest levels of the pragmatic self-system are optimally suited to assimilate almost any experience and thereby maintain stability at the higher levels of the self-system while lower levels
accommodate the new experiences (see also e.g., Brandtstädter, 1998; Greve & Ventura, 2003; Staudinger, in press). To give an example, we maintain our self-conception of being extraverted into old age even though at the behavioral level the frequency of social contacts decreases. This is possible because now being together with a few close friends is indicative of extraversion and not having many friends and seeing them very often as used to be the case in young adulthood (e.g., Carstensen, 1993). Thus, assimilation and accommodation are only mutually exclusive with regard to the same level within the self-system hierarchy (cf. Brandtstädter, 2001). But assimilative pursuits at one level in the hierarchy or in the service of one specific goal can bring about the need to accommodate at lower levels in our self-system. In order to understand change and stability of the self-system we need to consider the multiple levels of the self-system and the complex interactions within and between levels of the system. In addition, however, we also need to take into account the life mechanics relevant to self and personality functioning and how their developmental trajectories play out in the development of the self-system.

THE DEVELOPMENT OF THE LIFE MECHANICS AS RELEVANT TO SELF AND PERSONALITY FUNCTIONING

Let us start on some methodological notes (and regrets): When studying development, we usually are interested in mean-level as well as rank-order stability. That is, we ask whether the whole population exhibits normative change in mean levels or change in interindividual differences across the life span. And we often expect to find changing mean levels and simultaneously stable interindividual differences, i.e., high rank-order stability. However, as the aim of developmental psychology is to identify and explain intrapersonal change and interindividual differences in intrapersonal change (Baltes & Nesselroade, 1979), we also ought to consider individual-level change or ipsative stability. Unfortunately, as of today, statistical methods that allow modeling of individual-level stability and change are still rarely applied (cf. Nesselroade, 2002). In the following, therefore, we can only present evidence about mean-level and rank-order stability of various indicators of the mechanics and pragmatics of life.

Starting at conception there is a close interactive connection between the mechanics and pragmatics of life. Therefore, we face the basic problem that no “pure,” unequivocal physiological measures of the life mechanics are available. Much less even can we rely on behavioral observation or self-reports as these data heavily reflect the influence of the life pragmatics (cf. Baltes et al., 1998; Kagan, 1998). On that cautionary note, we will present developmental evidence on two of the physiological indicators that have been linked to basic dimensions of affectivity and motivation: autonomic reactivity and cerebral asymmetry. Those two indicators seem to be rather “pure” reflections of the life mechanics given presently available measurement paradigms and they have received most of the empirical attention. Nevertheless, we are aware that they only present a subset of the physiological indicators of temperament
and additional indicators could have been discussed here, such as a high level of excitability in the amygdala, asymmetric activation of the amygdala, norepinephrine, cortisol, or dopamine levels (e.g., Davidson et al., 2000; Depue & Collins, 1999; Kagan, 1998; Kosslyn et al., 2002; Rothbart & Bates, 1998).

**Autonomic Reactivity**

The parasympathetic and sympathetic branches of the autonomic nervous system influence the activity of the heart. Both higher sympathetic reactivity (e.g., Kagan, 1994, 1998) and a weaker influence of the parasympathetic nervous system (e.g., Porges & Doussard-Roosevelt, 1997) have been linked to behavioral inhibition (i.e., withdrawal/avoidance). Our focus in the subsequent section is on the relationship between heart rate and heart rate variability on the one and basic dispositions such as approach/avoidance or positive/negative emotional tone on the other hand. In addition, we are interested in developmental changes in cardiac activity and the stability of interindividual differences in heart rate and heart rate variability.

**Autonomic reactivity (heart rate, heart rate variability) and basic dispositions.**

High-reactive, irritable children have been shown to exhibit greater sympathetic reactivity compared to low-reactive, uninhibited children (Kagan, 1994, 1998). High-reactive infants tended to have higher fetal heart rates a few weeks before birth and higher sleeping heart rates at the age of two weeks compared with low-reactive infants (Snidman, Kagan, Riordan, & Shannon, 1995). A high fetal heart rate was also related to lower emotional tone (dullness) at 6 months of age (DiPietro, Hodgson, Costigan, & Johnson, 1996). Highly reactive, inhibited adolescents, however, cannot be differentiated from uninhibited adolescents based on their mean heart rate. But there is a tendency for inhibited as compared to uninhibited adolescents to react to challenges with stronger heart rate acceleration (Kagan, 1994).

Variable heart rates have been shown to be associated with a motivational tendency toward approach (Fox, 1989). Similarly, a low and variable resting heart rate is generally related to approach behavior and positive affect, but also to regulatory disorders and angry irritable affect (see Porges & Doussard-Roosevelt, 1997; Rothbart & Bates, 1998). These two findings seem contradictory, but match the special nature of anger. Albeit considered a negative affective state, anger is associated with a motivation to approach rather than avoid or withdraw (e.g., Davidson et al., 2000; Harmon-Jones & Allen, 1998). More importantly, however, these findings highlight the necessity to consider the regulation of the heart rate in response to stimulation in addition to the resting heart rate. Indeed, it is the physiological regulation of cardiac activity that has been suggested as “an antecedent substrate for emotional, cognitive, and behavioral regulation” (Doussard-Roosevelt, McClenny, & Porges, 2001, p. 58). Infants who have a low and variable resting heart rate and demonstrate appropriate heart rate modulation tend to show more optimal developmental outcomes. For example, they display fewer depressed behaviors and also fewer aggressive behaviors at 3 years of age (Porges & Doussard-Roosevelt, 1997; Porges, Doussard-Roosevelt,
Portales, & Greenspan, 1996). Similarly, very low birth weight infants who had a greater maturational shift toward a lower and more variable resting heart rate between 33 and 35 weeks gestational age were rated higher on social competence by their mothers when they were of school age (6-8 years old) than those with a higher and less variable heart rate (Doussard-Roosevelt et al., 2001). And infants whose heart rate increased during testing when they were 9 months of age were also rated as more socially competent by the age of 3 years than infants who showed less heart rate increase (Porges et al., 1996).

**Rank-order stability of autonomic reactivity.** Interindividual differences in fetal heart rate and heart rate variability are relatively stable between 20 and 39 weeks gestational age (overall means of all correlations between six measurements were \( r = .39 \) for heart rate and \( r = .43 \) for heart rate variability; DiPietro et al., 1996). From there on, age-related increases in stability of resting as well as stress-tested heart rate and its variability was observed (cf. Porges, Doussard-Roosevelt, Portales, & Suess, 1994). Stabilities of resting cardiac activity of up to \( r = .89 \) at 3 years and \( r = .86 \) in adulthood have been reported (Porges et al., 1994).

**Mean-level stability of autonomic reactivity.** Mean-level decreases in resting heart rate and increased variability have been observed in newborns (between 32 and 37 weeks gestational age; Doussard-Roosevelt et al., 2001) and between 9 months and 3 years of age (Porges et al., 1994). Unfortunately, to our knowledge no studies investigating the mean-level stability of heart rate and its variability from childhood into adulthood and old age are yet available. But there is evidence that the resting heart rates of older adults hardly differ from those of young adults, while maximum heart rate is considerably reduced with increasing age (Folkow & Svanborg, 1993). Heart rate response to cognitive or emotional stimuli is also attenuated in older adults (e.g., Garwood et al. 1982; Levenson, Carstensen, Friesen, & Ekman, 1991; see Baltissen, in press for an overview). This is in line with evidence on reduced reactivity of the autonomic nervous system (ANS) in old age (e.g., Frolikis, 1977). But we need not forget that old adults demonstrate more interindividual variability in cardiovascular functioning compared to young adults (Folkow & Svanborg, 1993), rendering them a more heterogeneous group. In addition, once the ANS is activated, there is indication that physiological adaptivity (e.g., refraction times) is slowed and/or reduced as compared to younger adults (e.g., Coper & Schulze, 1994; Finch & Seeman, 1999).

**Cerebral Asymmetry**

Over the last 15 years different laboratories have developed theories and accumulated empirical evidence concerning the idea that approach (Gray, 1981), activation (Cloninger, 1987), and engagement (Depue, Krauss, & Spoont, 1987) motivation on the one hand, and avoidance, withdrawal (Davidson, 1984), and inhibition (Cloninger, 1987; Gray, 1981) motivation on the other hand are related to different neural substrates, different basic emotions, and have distinct influences on action. The ap-
proach/engagement system facilitates appetitive behavior, generates particular types of approach-related positive affect, and is related to relative increases in left-sided prefrontal activation. There is some evidence that dopaminergic pathways play a central role in that system (e.g., Depue & Collins, 1999). The withdrawal/inhibition system, in contrast, responds to threats or signals of punishment. Its engagement inhibits ongoing behavior (Gray, 1981) or supports withdrawal behavior (Davidson, 1984) and involves negative affective states such as anxiety, disgust, and heightened vigilance. The activation of the inhibition/withdrawal system is associated with relatively stronger activation of the right prefrontal cortex.

**Cerebral asymmetry and basic dispositions.** Interindividual differences in baseline prefrontal activation asymmetry are related to differences in dispositional affect, inhibition, and differential reactivity to negative stimulation (Davidson et al., 2000; Kosslyn et al., 2002). For instance, infants with higher relative right anterior cortical activation at baseline are more likely to cry in response to being separated from their mothers compared with infants who do not show that asymmetrical activation pattern. Children with asymmetric right-sided anterior activation show a tendency toward inhibited behavior. During adulthood, greater relative activation of the right anterior cortex at rest has been related to higher levels of general negative affect, higher self-reported behavioral inhibition, stronger negative affect in response to unpleasant film clips, and slower recovery following a negative affective stimulus (for overviews see Davidson et al., 2000; Kosslyn et al., 2002).

**Stability of cerebral asymmetry.** Although there is evidence of internal consistency and test-retest reliability of measures of prefrontal asymmetry (Tomarken, Davidson, Wheeler, & Kinney, 1992), our knowledge about the intraindividual development of cerebral asymmetry is still very limited. Rank-order stability of baseline prefrontal asymmetries was very low over an 8-year period during childhood (Davidson & Rickman, 1999), but stability is assumed to increase after puberty when the prefrontal cortex has stopped to grow (Davidson et al., 2000).

In our literature review we could not find a study comparing the relative magnitude of prefrontal asymmetry between infants, children, and adults. Cerebral asymmetry has been demonstrated during the first year of life (cf. Davidson et al., 2000), but it is unclear whether these interindividual differences in brain activity stay stable over time. It has been speculated that the later development of left-brain abilities might be accompanied by a maturational shift toward better emotion-regulation (see Rothbart & Bates, 1998). Similar to research on heart rate and its variability, evidence on the mean-level stability of prefrontal asymmetry in old age is seemingly lacking. We only found one study of odor perception in older adults that showed that left frontal brain activation in response to pleasant stimuli was uncompromised. However, brain activity in response to unpleasant stimuli did not differ from that to neutral stimuli (Kline, Blackhart, Woodward, Williams, & Schwartz, 2000). This may imply that the right prefrontal cortex area undergoes stronger age-related changes in functioning than the left prefrontal area. Indeed, a reduction in hemispheric asymmetry has been reliably demonstrated for a number of cognitive performances, such as working memory and perception (Cabeza, 2002). Cabeza (2002)