A Life Span Model of Successful Aging

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To lay the foundation for our model, we first describe existing conceptions of successful aging, underlying assumptions of development, and criteria for success. The model presented extends the discourse on this topic in three directions: (a) It frames the discussion of successful aging in the broader context of life course development; (b) it accounts for both normative and nonnormative (i.e., exceptional) success; and (c) it integrates motivational processes into a theory of successful aging. Successful aging is equated with the development and maintenance of primary control throughout the life course, which is achieved through control-related processes that optimize selection and failure compensation functions. Selection processes regulate the choice of action goals so that diversity is maintained and positive and negative trade-offs between performance domains and life stages are taken into account. Compensation mechanisms serve to maintain, enhance, and remediate competencies and motivational resources after failure experiences. Both compensation and selection processes are motivated by desires for primary control and can be characterized in terms of primary and secondary control processes.

Investigators interested in aging have long recognized the importance of distinguishing between pathologic as opposed to normal aging. Thus, researchers interested in normative physiologic or cognitive age changes have been careful to exclude persons suffering from illnesses that might adversely affect performance and thus give a distorted picture of age-related declines. Although the distinction between aging as a disease and aging as a normative process is both important and useful, several researchers have recently argued that it does not go far enough (Baltes & Baltes, 1990; M. M. Baltes & Carstensen, in press; Rowe & Kahn, 1987). In particular, this simple bifurcation of the population into *diseased* and *normal* fails to recognize the large heterogeneity within the normal category. Moreover, what is observed to be normal does not necessarily tell us what is possible (Baltes & Baltes, 1990).

To address this shortcoming, researchers have further differentiated *normal* into *usual* and *successful* (Baltes and Baltes, 1990; Berkman et al., 1993; Rowe & Kahn, 1987). According to this distinction, individuals who exhibit typical nonpathologic age-associated changes would be classified as *usual agers,* whereas individuals who exhibit little or no loss in function relative to the average of their younger counterparts would be classified as *successful agers.* This distinction is important because it sensitizes us to the fact that what is observed to be statistically normative may in fact underestimate the age-related potential of a species under more ideal conditions. Advocates of the successful aging perspective emphasize the importance of factors such as diet, education, exercise, nutrition, and social support as moderators of the aging process (Rowe & Kahn, 1987). The term *optimal aging* has been introduced as a variant of successful aging. It emphasizes the theoretical potential of the aging organism, "a kind of utopia, namely, aging under development-enhancing and age friendly environmental conditions" (Baltes & Baltes, 1990, p. 8).

Although the distinctions made above are useful, they provide only rough guidelines for characterizing the aged and the aging process. Given the proliferation of literature on successful aging (M. M. Baltes & Carstensen, in press; P. B. Baltes, Smith, & Staudinger, 1992; Black, Isaacs, & Greenough, 1991; Brandtstädter & Greve, 1994; Fries, 1989, 1990; Hazzard, 1983; J. Heckhausen & Schulz, 1993, 1995b; Herzog & House, 1991; Lehr, 1982; Lehr & Thomae, 1987; Marsiske, Lang, Baltes, & Baltes, 1995; Thomae, 1970, 1983) and the widespread interest in this topic, we thought it important to elaborate and more clearly define these and related constructs.

The recent emphasis on successful aging has been useful in focusing our attention on developmental phenomena in the second half of the life course, but this literature has an important shortcoming in that discussions of development in late life are not integrated with perspectives on development in infancy and childhood. The idea of taking a life course perspective on develop-

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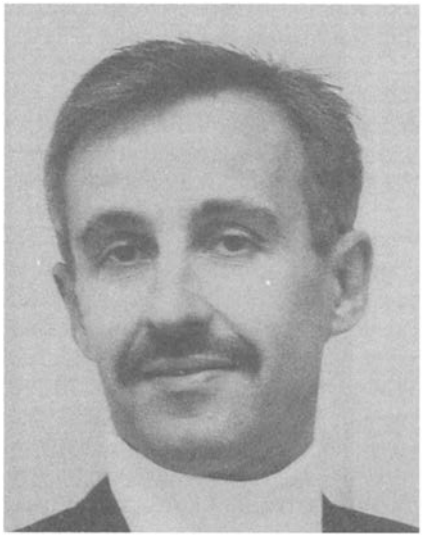

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ment is emphasized by Marsiske et al. (1995) when they described successful development as lifelong adaptation. Successful development is possible throughout the life span, and a comprehensive theory of development should be able to explain developmental phenomena from infancy to old age.

To present our model of successful aging within a life course perspective, we first examine four basic parameters of life course development. This is followed by a discussion of criteria for successful development, general principles regulating development across the life course, and our own model of developmental regulation. We conclude by reexamining the concept of successful aging from the perspective of our model and exploring some of the research implications of this view.

Parameters of Life Course Development

No one is born old. To be old means that one necessarily has a past history and a potential future that provide a context for characterizing the individual at a given point in time. This idea can be extended to individuals of all ages and emphasizes the importance of viewing life as part of a continuous and dynamic stream with a beginning and an end. As the contours of land determine the directions of its flow, the life course of individuals is broadly constrained by biological and social forces that fundamentally shape the development of the organism. Inasmuch as these constraints affect how we conceptualize and define aging, it is important that we identify them here.

Life Is Finite

Whatever is to be achieved or experienced in life has to be done in a finite period of time, typically less than 80 years. Because the acquisition of skills, knowledge, and high levels of expertise takes time (Ericsson & Charness, 1994), the individual is constrained to the extent to which functioning can be maximized in multiple different domains. Moreover, because there are absolute limits to the amount of time available to live one's life (Fries, 1983), there are limits on our ability to effectively shift from one domain to another. At any given point in an individual's life, the anticipated amount of time left to live may shape behavior and affect in important ways. A case in point is career planning near retirement age. There is a point in the life course beyond which one has to settle for what one has, rather than entertain ideas about possible career changes (Neugarten & Hagestad, 1976).

Biological Development Follows a Sequential Pattern

Although there is considerable interindividual variability in biological development, the overall biological resources across the life span resemble an inverted U-function. During childhood and adolescence, cognitive and physical abilities increase and provide the bases for the development of complex motor and cognitive skills. During early adulthood, physical development plateaus and then later declines (Schulz & Curnow, 1988; Schulz, Musa, Staszewski, & Siegler, 1994). In old age, declines in both physical and cognitive functioning are evident (Berkman et al., 1993), although the rate of decline and domains in which decline occurs is quite variable and may not be irreversible (Schaie, Willis, & O'Hanlon, 1994). We agree that there is a great deal of interindividual heterogeneity in human aging (P. B. Baltes, Smith, & Staudinger, 1992), but there is also consistency and homogeneity, as shown by these broad invariant age-related changes. Thus, it is unlikely that either an 80-year-old or a 10-year-old will ever achieve a world record time in the 100-meter dash.

Societies Impose Age-Graded Sociostructural Constraints on Development

Life span psychologists and life course sociologists emphasize that all societies can be characterized as having age-graded systems that constrain and provide a scaffold for life course patterns (P. B. Baltes, 1991; Hagestad, 1990; Hagestad & Neugarten, 1985; J. Heckhausen, 1990, 1995). These patterns provide predictability and structure at both individual and societal levels. Societies define normative ages for important life events and transitions, sometimes referred to as *developmental tasks* (Havighurst, 1973). The prototypical case is fertility in women, which is shaped by both social institutions and biological constraints. In addition, age-sequential constraints result from a channeling of developmental and life course processes into biographical tracks (Blossfeld & Mayer, 1988; Featherman & Lerner, 1985; Geulen, 1981; Mayer, 1986). An example is professional specialization, which yields ever-increasing levels of expertise in the chosen field while giving up on nonchosen alternatives. Within such developmental tracks, functioning is optimized, whereas crossovers to alternative life tracks become increasingly difficult.

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Genetic Potential Is a Limiting Factor on Functional Development

Although the potential behavioral repertoire of humans is vast, the capacity to achieve extraordinary levels of functioning in a given domain may be constrained by the genetic makeup of an individual. For example, becoming a professional athlete in sports such as basketball and football is improbable for individuals who do not possess the genetically determined physical attributes required by these sports. One of the important challenges for maximizing functioning over the life course is to provide young children with adequate opportunities to test out their genetic potential so that there is a good match between the genetic makeup of the individual and a selected life track. Scarr and McCartney (1983) referred to this process as *niche-building* and suggested that "children select and build niches that are correlated with their talents, interests, and personality characteristics" (p. 433).

The Criterion Problem

As noted by others (M. M. Baltes & Carstensen, in press; Baltes & Baltes, 1990), terms such as *successful* or *optimal* imply a value judgment about something that is good and desirable. Some advocates of successful aging focus on outcomes such as cardiovascular and pulmonary functioning and the absence of disability as measures of success (Berkman et al., 1993; Rowe & Kahn, 1987). Others emphasize cognitive and intellectual performance as measures of success (Lehman, 1953; Salthouse, 1991; Simonton, 1988a, 1988b, 1994), whereas still others focus on achievements in physical (Ericsson, 1990; Ericsson & Charness, 1994; Schulz & Curnow, 1988; Schulz et al., 1994) or artistic domains (Ericsson, Krampe, & Tesch-Romer, 1993; Lehman, 1953; Simonton, 1988a, 1994). A common feature of all of these criteria is that they focus on broad measurable domains of functioning or performance that can be applied to any stage of the life course, and for which there exists broad societal consensus that the higher the level of functioning or performance, the more successful the individual.

A variation of this approach uses the same outcome measures but views them through a relativist filter (Schulz & Hanusa, 1980). Thus, we may take into account contextual environmental or biological factors in assessing the success of an individual. For example, an individual with polio may be very limited in physical functioning when viewed through the lens of absolute or normative standards, but may be exceptional when other standards (e.g., compared with persons afflicted with polio) are applied. The same type of analysis could be applied to a very old person who is extraordinarily physically active. When compared with peak performance of elite athletes, such an individual might be viewed as dysfunctional, but compared with others of the same age, the same person could be assessed as superfunctional. In summary, three different types of standards can be invoked to assess individual performance within a given domain: an absolute standard, in which the highest levels of known human performance in a given domain defines the upper limit; an interindividual relative standard, which is based on membership in a particular reference group defined by age or other characteristics (i.e., interindividual social comparisons); or an intraindividual relative standard, one based on the specific performance history of a given individual (i.e., intraindividual temporal comparisons; Schulz & Hanusa, 1980; Suls & Mullen, 1982).

Another approach to defining successful aging focuses more on the subjective psychological experience of the individual. This approach is in part captured by the notion that it is not so much what you do or accomplish in life but rather how you feel about it. In contrast to performance-based criteria, this perspective emphasizes satisfaction with experienced outcomes as a primary criterion of success. A variant of this perspective is to define success in terms of *goal attainment,* subjectively defined as the realization of desired outcomes and the avoidance of undesired outcomes. The key feature of these criteria is that success is defined in relation to personal goals and aspirations that are thought to vary over time and sociocultural contexts. Thus, individuals who, by some objective standards, accomplish relatively little within a given domain or who aspire toward and achieve highly idiosyncratic goals can experience high levels of satisfaction and success. Adopting these highly individualized and subjective criteria as gauges for successful development seems to us problematic for several reasons. First, they open the door for any indicator to meet the criteria of success because the criteria are individually determined. Second, they are subject to the rationalization biases characteristic of individuals when they evaluate their own experiences and accomplishments. Third, this perspective fails to take advantage of the fact that all cultures are characterized by considerable consensus regarding what constitutes success.

For these reasons, we feel it important to focus on criteria of success that are externally measurable and include domains of functioning that have been and continue

to be valued by cultures throughout time. These include physical functioning; cognitive, intellectual, affective, and creative functioning; and social relations. We recognize and acknowledge that trade-offs have to be made in attempting to maximize functioning in individual or multiple domains and that performance can be evaluated comparatively, as specified above. In this context, subjective evaluations such as satisfaction with aging can be viewed as one of many components of affective and intellectual functioning, but they are not treated as major criteria of successful development in their own right.

Finally, it is important to note the difference between evaluating performance and functioning at a given point in an individual's development and evaluating the totality of an individual's life. There is a tendency among researchers on successful aging to define success in terms of functioning in one or several domains at a specific temporal point. Such an assessment may not take into account the totality of an individual's life history or all of the relevant domains by which one might be evaluated. In general, it is much easier to determine if people have done well within a particular domain than it is to determine whether they have lived a successful life. Similarly, we can define optimal functioning as the convergence of genetic potential, biological capacity, acquired knowledge and skills, motivation, and sociostructural opportunities to maximize performance in a given domain; however, defining the optimal life course is more complex because we must consider functioning in multiple domains over long periods of time, which involve sequential variations in biological and sociostructural opportunities and constraints.

General Principles Regulating Development Across the Life Course

Having identified some basic parameters of life course development as well as criteria for success, we focus now on general principles for constructing a successful life course.

Human beings have a vast potential for what they can become and accomplish in a lifetime. To some extent, this potential is constrained by the genetic makeup of the individual. In extreme cases involving congenital illnesses, the constraints may be severe enough to make a typical life course difficult to achieve. For most individuals, the genetic potential is not a major constraint and is, in any case, relatively unknown.

Although much of infancy and childhood is characterized by generalized skill acquisition and cognitive development, one of the initial challenges faced by socializing agents—such as parents—is to provide to children opportunities to sample diverse domains so that there is some convergence between the inherent abilities of the child and the investment of time and effort. Identifying such a convergence and subsequently investing large amounts of training resources in a specific domain is often characteristic of children who ultimately develop world-class expertise in areas such as playing a musical instrument or becoming a professional athlete (Ericsson et al., 1993). On the whole, though, social systems are designed to maximize the acquisition of broad generalizable skills throughout infancy, childhood, and adolescence.

During late adolescence and young adulthood, there is increasing pressure for specialization as individuals embark on individualized career paths. How much time and energy one should invest and in what specific domains are some of the challenges faced by individuals in this stage of development. Because of biological limits on the length of life, the age-graded structure of the life course, and the fact that skill acquisition takes a relatively long period of time, the individual has few opportunities to make mistakes in choosing domains for expertise development. To the extent that individuals invest in the development of domains that are highly generalizable (e.g., traditional academic skills), the number of alternative career paths remains relatively high. On the other hand, investing in highly specialized domains (e.g., athletic performance in a specific sport) is much riskier because failure to achieve professionally competitive levels of performance leaves one with few alternative domains to pursue. This is the classic dilemma of high school or college athletes who invest great energy in developing expertise in their chosen sport but who are not good enough to become professional athletes. In summary, desirable features for early life course development are exposure to diversity followed by selective investment in highly generalizable domains.

Taken together, this characterization of development suggests four general principles for maximizing development across the life course. First, there must be diversity in the opportunity to sample different performance domains. Second, there has to be selectivity in pursuing and allocating resources to developmental paths that are consistent with genetic and sociocultural opportunities. Third, the individual must compensate for and cope both with failure encountered as different action goals are pursued and with declines associated with late life development. And fourth, the individual must manage trade-offs across domains and sequential life phases and recognize that the allocation of resources to one domain may compromise the opportunity to develop others.

Diversity in functioning is important for optimal development for several reasons. Maintaining diversity reduces the risk and vulnerability associated with narrow specialization. More important, however, diversity provides the raw material or basis for future developmental advances. In this way, diversity in human development is analogous to the role of variability in evolutionary change (Scarr, 1993). Variability provides the options that selection as the basic evolutionary process can work on. The principle of diversity has important implications for socializing agents responsible for childhood development. Early in their development, children should be exposed to a variety of domains of functioning so that they are challenged, develop diverse skills, and have the opportunity to test their genetic potential.

A second principle regulating development is selectivity. To realize their developmental potential, individuals must selectively invest time and energy resources. Because the repertoire of human behaviors is so vast and time is limited, the organism must identify which options to pursue and which to give up relatively early. Selectivity must work hand in hand with diversity so that the potential for high levels of functioning in some domains is maintained while, at the same time, broad, generalizable skills are developed. Such general purpose skills and abilities are likely to exhibit positive transfer to many different domains, avoiding the problems associated with narrowly focused selection.

A third hallmark of human development is compensating for and coping with failure and decline. Three types of failures or developmental challenges are identified in our model: (a) normative developmental failure experiences encountered when individuals attempt to enlarge their competencies, (b) developmental declines characteristic of late life, and (c) nonnormative negative events.

Human beings are unique even among mammals in that little of their behavior is prewired: Almost all competence must be acquired through learning. The acquisition of new skills and knowledge is maximized when engaging challenges that are of intermediate levels of difficulty, at which failure occurs at least some of the time. This level of challenge engages individual capacities that are not yet fully realized but are well within reach. Indeed, humans show a strong preference for tasks of intermediate levels of difficulty when compared with tasks they can easily accomplish or that are out of their reach (Lewin, Dembo, Festinger, & Sears, 1944). One consequence of this it that people have to cope with regular and frequent failures in attaining the action goals they set for themselves.

A second type of challenge occurs during middle and old age, when individuals reach the downward slope of the inverted U-function and experience declines in their ability to do some of the things that they were once able to do.

The third type of challenge involves the myriad of negative and often random events that befall humans in their everyday lives. This might involve a physical assault such as a severe illness or other stressful life event such as job loss. Taken together, these experiences elicit multiple responses: frustration of goal attainment and negative perceptions of the self. Compensation for frustration is important because without it the individual would not persist in the face of failure. It fosters commitment to a goal even in the face of obstacles. Failure experience may also undermine individuals' sense of themselves, their level of self-ascribed competencies, and their general self-esteem. All of these consequences can undermine future motivational resources for development. As a result, the organism needs specifically adapted strategies to compensate for failure experiences that may undermine the self-concept.

The fourth principle concerns the management of trade-offs between domains and life span phases. Selective investment in a given functional domain at a certain point in the life course often has important implications for alternative domains that compete for resource investment. These implications may be positive or negative. In general, investing in broad skills and abilities is likely to have positive trade-offs to other domains of functioning pursued in subsequent life span phases, whereas narrowly focused investments are likely to be more limited in their applicability to alternative or subsequent developmental paths. Thus, one of the major challenges faced by individuals throughout the life course is assessing what the trade-offs are for a given investment of time and effort and making decisions about whether to continue within a given domain or switch to another.

These principles apply to development throughout the life course, including adulthood and old age. Because of age-related changes in the physical capacity of individuals and constraints imposed by society, it is important that individuals avail themselves of a diverse range of performance domains available to them. Diversity is important throughout the life course for optimal development (Adelman, 1994). The choice of domains to be sampled and developed should be consistent with the capacity of the individual, and trade-offs between selected and nonselected options must continue to be managed. Managing trade-offs among alternative domains becomes a major challenge during adulthood, when individuals must regulate multiple domains both sequentially and in parallel. Finally, the process of life course development is necessarily punctuated by failure. The individual must develop resilience to effectively cope with these failures.

The importance of these principles is perhaps best understood if we apply them to some specific examples. Consider the life course of a world-class professional athlete. The genetic potential of such individuals is typically recognized early in life either because the child exhibits extraordinary athletic performance or because one or both parents were themselves professional athletes and therefore the potential is assumed to be there. This in turn results in the allocation of resources (e.g., time, energy, and money) to the development of skills in the chosen sport. In extreme cases, the allocation of resources may be so focused on a particular activity that the development of more generalizable skills is neglected. Because professional athletics are highly competitive, the timing of training and skill acquisition must be carefully orchestrated to converge with the biological development of the individual. In most sports, peak levels of performance are achieved between the ages of 20 and 30, and the individual requires about 10 years of intensive training to be professionally competitive. Thus, many children begin intensive training programs at about age 10 so that they are prepared to become professionals in their late teens or early 20s. If the individual overcomes the failure experiences along the way and succeeds in making it into the professional ranks, the rewards can be great in terms of financial resources and recognition. However, athletic

careers tend to be short-lived as the effects of biological declines, wear-and-tear, and injuries take their toll on the individual's ability to remain competitive.

In terms of the principles articulated above, the life course of a professional athlete is characterized by low levels of diversity in athletes' exposure to multiple performance domains and selective allocation of resources into one or few domains very early in life. It is also characterized by high levels of resilience, but of a type that is likely to be very domain specific. We consider this a high-risk life course trajectory because (a) the probability of achieving the primary goal is low, (b) it leaves the individual with few alternative options if the primary goal is not achieved, (c) it may lead to resilience in very limited domains, and (d) it is aimed at only half of the normative life course (e.g., the first 30 to 40 years). Even if individuals reach their primary goal of becoming a professional athlete, they must still develop and implement life course plans for the postprofessional period of their lives.

A similar analysis could be applied to the development of performing artists such as musicians and dancers. However, there are some differences between these domains and professional sports. First, there are a variety of fallback positions available if the individual does not attain world-class levels of performance. For example, a musician who does not succeed as a soloist can join an orchestra or become a teacher. Second, the careers of performing artists tend to be longer than those of professional athletes. Thus, individuals who do achieve their primary goal can anticipate spending most of their adult lives working in their chosen domains.

Professional athletes and world-class performing artists represent unique life course trajectories in that the development of the individual is focused on achieving optimal performance in a specific domain. This analysis could be extended and applied to peak performance in virtually any measurable domain. Indeed, a number of researchers have argued that the age–performance functions described in the peak performance literature provide fundamental insights into the biological and cognitive developmental potential of the human organism (Schulz & Curnow, 1988; Schulz, Musa, Staszewski, & Siegler, 1994).

It could be argued that few individuals aspire toward world-class performance or even that the costs of aspiring to such levels of performance are too high in terms of time and energy invested, and as a result such individuals do not serve as good models for characterizing the lives of most people. Most individuals spend their early years developing highly generalizable skills while at the same time sampling more specialized domains such as athletics and the performing arts. Exclusive investment in any one domain is avoided; instead, trade-offs across multiple domains are managed such that options for future developmental paths remain numerous. Educational systems in the United States and many other countries emphasize the development of generalized skills prior to specialization.

A Model of Developmental Regulation Across the Life Course

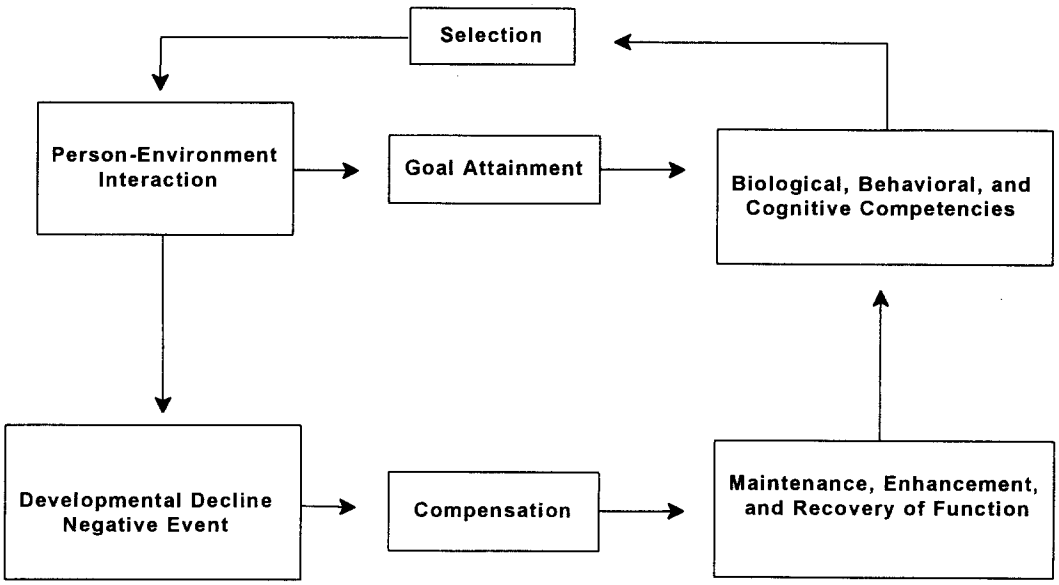
As noted above, the fundamental requirements of developmental regulation across the life span are managing diversity and selectivity and developing the capacity to compensate for failure. How is this to be achieved? Our general model of successful development is presented in Figure 1. Key elements of this model are the processes of selection and compensation (Baltes & Baltes, 1990).

Selection mechanisms direct the person–environment interactions and provide both diversity and focus in the choice of domains pursued. Selection processes are guided by a consideration of interdomain and temporal trade-offs. Person–environment interactions primarily yield two types of outcomes: success and failure experiences. Successes help maintain existing levels of competence and develop new ones. Failure experiences, on the other hand, have the potential of undermining existing competencies. As a result, compensation mechanisms are needed to protect the individual from these threats. Such compensating mechanisms promote the maintenance, recovery, and enhancement of functioning.

Most existing theories of successful aging focus on compensating for failure and decline. Investigators interested in this area have focused on a variety of mechanisms aimed at maintaining or recovering functions that normatively decline in late life. For example, Rowe and Kahn (1987), in their classic article on usual and successful aging, described ways in which elderly individuals can prevent, maintain, remediate, or compensate for declines in carbohydrate metabolism, bone density, and cognitive function. Similarly, Salthouse (1991) focused on accommodation, remediation, and compensation as mechanisms for coping with cognitive declines in late life. Backman and Dixon (1992) provided a fine-grained analysis of these processes in their description of compensatory mechanisms. Brandtstädter and colleagues (Brandtstädter & Greve, 1994) and P. B. Baltes and M. M. Baltes and colleagues (Marsiske et al., 1995) identified mechanisms similar to those of Rowe and Kahn and Salthouse, but developed a more elaborate framework that emphasized both compensation and selection processes.

Accommodative strategies include activities such as rearranging personal goals, values, and aspirations. Prevention and maintenance involves focused activity aimed at forestalling or eliminating normative declines and might include specific activities such as changing one's diet. Remediation is achieved when a prior level of ability or functioning is restored through an intervention. A common example would be the restoration of atrophied muscle through exercise. Compensation includes a broad array of activities in which functioning is maintained or enhanced or a goal is achieved through alternative means such as assistive devices like glasses or the help of others (Backman & Dixon, 1992). The broad consensus among these divergent theoretical positions suggests that any theory of successful aging must incorporate similar mechanisms.

Figure 1
A General Model of Development



Models of successful aging have been useful in focusing our attention on developmental phenomena in the second half of the life course, but they also have a number of limitations. Because they were designed to address issues of decline in middle and old age, they contribute little to our understanding of developmental regulation during early stages of development when the emphasis is on the expansion and growth of functional abilities. Theories of child development, on the other hand, have focused on the maturation and acquisition of skills and say little about developmental decline common in late life. Only Baltes and colleagues, in their theory of selective optimization with compensation, have extended their theory to encompass development from infancy to old age. They have achieved this by focusing on "how individuals and life environments can manage opportunities for, and limits on, resources at all ages" (Marsiske et al., 1995, p. 6).

Although theories of child and adult development overlap in some areas and are complementary in others, they leave a number of key questions unanswered. For example, what is the relative importance of selection and compensation processes at different stages in the life course? What motivates selection and compensation mechanisms? How are they regulated and managed to optimize development over the life course? What does it mean to develop successfully over the life course as opposed to developing successfully during childhood or old age?

To address these questions, we recently articulated a life course theory of control that provides a basis for the derivation of a life span model of developmental regulation (J. Heckhausen & Schulz, 1995a).

The life span theory of control proposes the construct of *control* as the central theme for characterizing human development from infancy to old age. The underlying assumption of this position is that humans desire to produce behavior–event contingencies and thus exert primary control over the environment around them throughout their life span. We further distinguish between primary control and secondary control. *Primary control* targets the external world and attempts to achieve effects in the immediate environment external to the individual, whereas *secondary control* targets the self and attempts to achieve changes directly within the individual. Both primary and secondary control may involve cognition and action, although primary control is almost always characterized in terms of behavior engaging the external world, whereas secondary control is predominantly characterized in terms of cognitive processes localized within the individual.

J. Heckhausen and Schulz (1995a) further emphasized the functional primacy of primary over secondary control. Because primary control is directed outward, it enables individuals to explore and shape their environment to fit their particular needs and optimize their developmental potential. Without engaging the external world, the developmental potential of the organism cannot be realized. As a result, it is both preferred and has greater adaptive value to the individual.

Extensive empirical research suggests that striving for primary control is inherently part of the motivational systems of mammals. The developmental origin of activities directed toward controlling external events and ac-

quiring generalized expectations about control can be traced to the very beginning of life. Even neonates are able to detect behavior–event contingencies (Janos & Papousek, 1977), and mammals of all types prefer behavior–event contingencies to event–event contingencies, even in the absence of consummatory behavior (Singh, 1970). The striving for primary control assures development within specific domains as well as the sampling of diverse domains over time (cf. White, 1959). Primary control provides the foundation for diversity and selectivity throughout the life course. The development of primary and secondary control over the life course is illustrated in Figure 2.

Early development is characterized by an increased ability to exert primary control over the environment. The action–outcome experiences of the child provide the basis for the development of self-competence, including generalized and exaggerated expectancies of control and perceptions of self-efficacy. Children between the ages of three and four are able to experience appropriate emotional reactions to failure (Geppert & Heckhausen, 1990; H. Heckhausen, 1984) and therefore require compensating mechanisms to counteract this threat to their motivational resources. During childhood and adolescence, a broad range of secondary control strategies develop, including changing aspiration levels, denial, egotistic attributions, and reinterpretation of action goals (see review in J. Heckhausen & Schulz, 1995a). Perceptions of control are highly exaggerated early in life (Weisz, 1983), showing little correspondence to actual primary or secondary control. This delusional sense of control is adaptive in that it provides the motivation to engage the environment at a time when the organism is rapidly developing.

Early adulthood is characterized by increasing levels of primary and secondary control as well as increased selectivity with respect to the domain specificity of control. Selectivity continues to increase throughout adulthood, whereas diversity gradually decreases. Because of the limited capacity of the individual and external constraints, the increased selectivity at older ages has to be compensated for with decreased diversity. This trade-off between diversity and selectivity is a hallmark of development in late middle and old age.

During late middle age and old age, the strategy of choice leans more toward the elaboration and increased use of secondary control strategies (J. Heckhausen, in press-a, in press-b). Increasing age-related biological and social challenges to primary control put a premium on secondary control strategies as means for maintaining the potential for primary control. As the ratio of gains to losses in primary control becomes less and less favorable, the individual increasingly resorts to secondary control processes.

Throughout the life course, primary and secondary control work together to optimize development of the organism through selection processes and compensation of failure. As shown in Figure 3, motivation for primary control is a central driving force in our model, although we acknowledge that other motivational forces not shown in our model (e.g., need for autonomy and relatedness; Deci & Ryan, 1985) also motivate human behavior. This model shows how the motivation for primary control provides both the impetus for and regulation of the individual's interactions with the environment. Viewed sequentially, our model indicates that person–environment interactions are driven by the motivation for primary control and are guided by selection processes. Selection processes are in turn regulated by the competencies and motivational resources of the individual. A given interaction will result in either positive outcomes, such as goal

Figure 2
Availability and Use of Primary and Secondary Control Over the Life Course

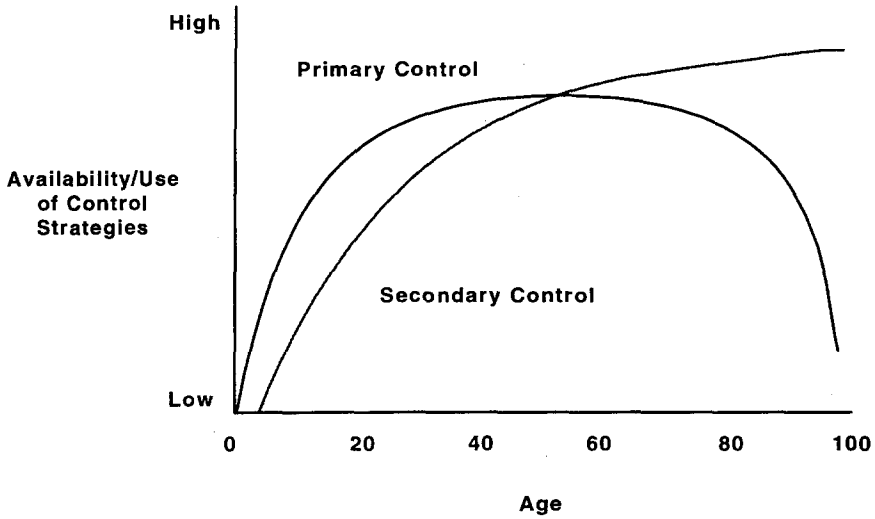
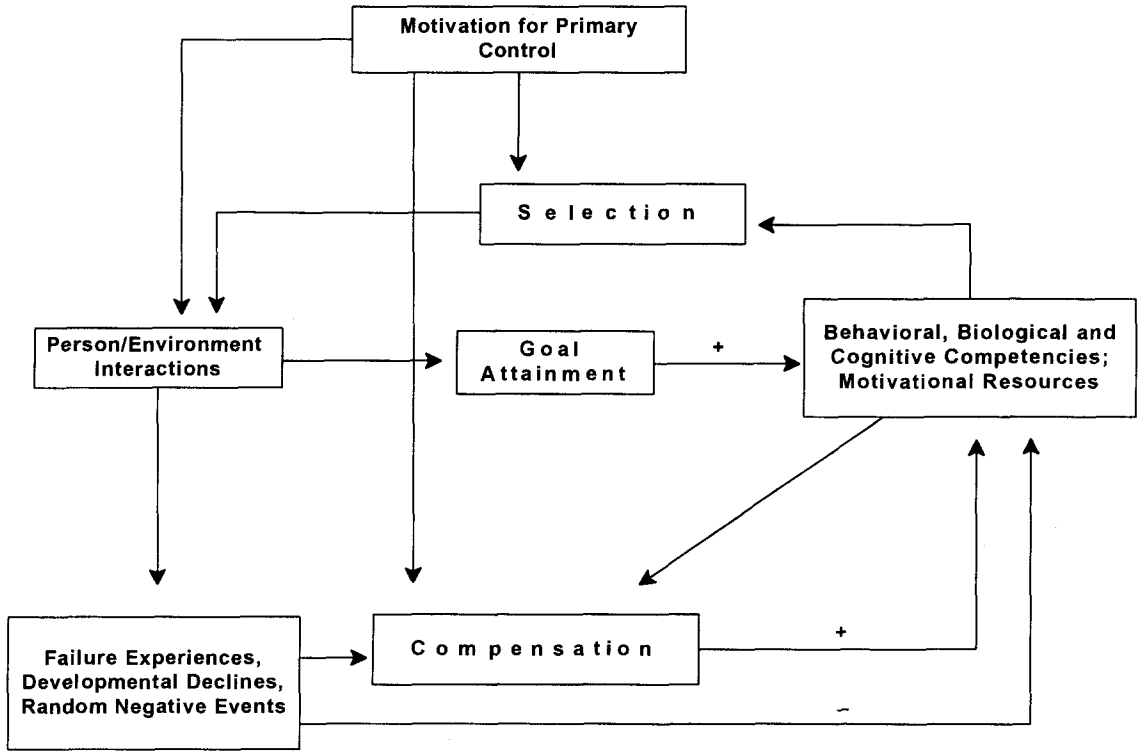


Figure 3
The Role of Primary Control in a Life Span Model of Successful Development



attainment, or negative outcomes, such as failure. Goal attainment leads to the maintenance or enhancement of competencies and motivational resources.

In contrast to other models of successful aging, we identify three types of potential failure experiences: (a) normative developmental failure experiences encountered when individuals attempt to enlarge their competencies, (b) developmental declines characteristic of late life, and (c) nonnormative or random negative events. These failure experiences have the potential to undermine competencies and motivational resources and, therefore, require some form of compensation. Compensation mechanisms serve to maintain, enhance, and remediate competencies and motivational resources. The other central mechanism identified in our model is selection. Selection processes regulate the choice of action goals so that diversity is maintained and positive and negative trade-offs between domains and life stages are taken into account. Moreover, selection processes manage the allocation of motivational and behavioral resources to goals that have been selected. Both compensation and selection processes are motivated by desires for primary control and can be characterized in terms of primary and secondary control processes.

Four control-related processes characterize selection and compensation (J. Heckhausen & Schulz, 1993). *Selective primary control* refers to the focused investment of resources such as effort, time, and abilities and skills required for a chosen goal. Development of skills and abilities through processes of acquisition and practice are also examples of selective primary control. *Selective secondary control* targets internal representations that are motivationally relevant to goal pursuit. Relevant representations include the value ascribed to the chosen goal, the values associated with alternative goals, the perceived personal control of goal attainment, and the anticipated effects or consequences of goal attainment. Thus, selective secondary control effectively enhances the value of a chosen goal, while devaluing nonchosen alternatives.

Compensatory primary control is required whenever the physical or cognitive capacities of the individual are insufficient to attain a chosen goal. This may happen in older adults because of age-related declines, but also in infants, children, or inexperienced individuals in general because of immaturity or insufficient skill. Compensatory primary control refers to the use of external resources such as assistance from others or technical aids such as wheelchairs or hearing aids. *Compensatory secondary control* serves to buffer the negative effects of failure or losses on the individual's motivation for primary control. P. B. Baltes and M. M. Baltes and colleagues have referred to similar phenomena as "resilience of the self" (Baltes & Baltes, 1990; P. B. Baltes, Smith, & Staudinger, 1992;

Staudinger, Marsiske, & Baltes, 1993). Compensatory secondary control strategies include disengagement from prior goals (e.g., "sour grapes"; Elster, 1983), engagement with new alternative goals, self-protective patterns of causal attribution (Snyder, Stephan, & Rosenfield, 1978), strategic social comparison with others (Wood, 1989), and strategic intraindividual comparisons (Ryff, 1991; Suls & Mullen, 1982). Although we have emphasized the functional or adaptive aspects of each of these strategies, it is important to note that each has a dysfunctional counterpart (see J. Heckhausen & Schulz, 1995a, for a discussion of dysfunctional primary and secondary control strategies). In general, these strategies become dysfunctional when they undermine the long-term primary control potential of the individual.

To the extent that individuals are able to use these strategies in ways that maximize their long-term primary control potential, we would judge them to be optimizing development throughout the life course.

Models of Aging Reconsidered: Successful Aging as Successful Development

Implicit in our view of developmental regulation is the idea that successful aging includes the development and maintenance of primary control throughout the life course. Put another way, individuals who are able to engage and impact the environments around them for the longest period of time would be judged most successful. Although this definition implies an absolute definition of success—the more primary control the better—it is important to note that at the individual level, the potential for primary control is limited by the genetic makeup of the individual and the available sociocultural opportunities. Thus, evaluations of success must be tempered by the biological and sociocultural resources of the individual.

We stress that both process and outcome criteria should be used as indicators of successful development. This perspective emphasizes that the development and utilization of appropriate mechanisms are likely to achieve the best outcomes. In general, *process indicators* are defined as the functional primary and secondary control strategies identified by J. Heckhausen and Schulz (1995a). Indirect evidence demonstrating the adaptive value of diverse primary and secondary control strategies was reviewed by J. Heckhausen and Schulz (1995a), and direct measures aimed at assessing interindividual variability in the utilization of these strategies are currently underway (J. Heckhausen & Schulz, 1995b).

We favor the application of absolute and measurable performance criteria (tempered by contextual opportunities) in domains such as cognitive, intellectual, and physical functioning. Indeed, our emphasis on the long-term primary control potential of the individual argues that at minimum, the organism must be alive: Beyond this requisite, it must have the physical capacity to engage the environment. Thus, our views of successful aging converge with those of Rowe and Kahn (1987), who focused on physical functioning and the absence of impairment and disability as criteria for successful aging. The control perspective acknowledges survival and physical functioning as the fundamental or superordinate criteria of success. Behaviors that maximize individual longevity and physical functioning potential should therefore receive high priority throughout the life course.

Generalized cognitive, intellectual, and social relational skills are second-order criteria of success. These abilities, along with physical or biological status, define the primary control potential of the individual and lie at the heart of our idea of successful development. Because failure and declines are inevitable features of development, it is essential that the organism has a means for dealing with failure in a way that does not jeopardize future development or undermine gains that have already been attained. Primary and secondary control strategies provide mechanisms for achieving this, and we would anticipate that individuals with higher cognitive, intellectual, and social relational skills would have higher reserves of resilience to draw upon than individuals with lesser developed abilities. When confronted with developmental challenges, such individuals will be able to maintain or enhance existing levels of primary control.

Ability or performance within a specific domain represents a third-order criterion of success. The primary control potential of a given domain depends largely on how narrow the domain is. Broad domains that are supported by generalizable skills have great primary control potential over the entire life span, whereas narrow domains that rely on abilities with little potential for transfer to other contexts have little generalized primary control potential.

It is possible that all three criteria of success are maximized within one individual. Such a person would demonstrate success within one or several domains; develop high levels of cognitive, intellectual, and social relational skills; maintain near-optimal levels of physical functioning; and be highly resilient to external threats throughout most of the life course. From our perspective, fulfilling the combination of these criteria represents the optimal life course. This should be contrasted with optimal functioning, which can be achieved only within a given domain within a relatively narrowly defined chronological age window and often entails trade-offs that make an optimal life course difficult to achieve. Examples of optimal life course development might include professionals such as Supreme Court judges who develop high levels of expertise in at least one domain; generally have high levels of cognitive, intellectual, and social relational skills; and maintain their abilities well into late life.

These examples, like most individuals, represent cases in which the sociocultural opportunities or genetic potential fall within the normative to exceptional range. However, a significant portion of any population is constrained by sociocultural or physical limitations. This might be the case, for example, with an individual with physically limiting congenital birth defects. Is it possible

for such an individual to develop successfully? On the basis of our criteria, the answer is yes. Although such an individual may not achieve greatness by absolute standards within those domains limited by disability, relative success within those domains can be achieved. Externally imposed limitations within one domain also help to direct resources to other domains wherein high levels of functioning can be attained. Thus, the range of options may be limited, but the opportunity to excel in most domains is not. This example illustrates that the application of our criteria of success must be tempered by the sociocultural opportunities and genetic potential of the individual.

Propositions for Successful Life Course Development and Future Research

The theoretical perspective articulated in this article has important implications for future research. Before we identify possible avenues for future development, it is useful to briefly summarize the key propositions of the model we have presented:

1. Diversity provides the foundation for selectivity.
2. Selectivity is limited by sociocultural opportunity, the genetic make-up of the individual, and time. Development within a particular domain may be constrained for a given individual because of any one or a combination of these factors.
3. Diversity and selectivity have optimal life course patterns. Diversity is more important early in life, whereas selectivity becomes more important later in life.
4. Selectively focusing on a particular developmental domain has costs and benefits. Competencies within the chosen domain are enhanced, but at the cost of developing nonchosen alternatives.
5. Failure is an inherent part of the acquisition and decline of individual competencies.
6. Failure has the potential of undermining future development and therefore requires compensatory processes to ensure continued development.
7. The motivation for primary control fuels development throughout the life course.
8. The motivation for primary control regulates selection and compensation processes.
9. Primary and secondary control vary systematically over the life course and provide the mechanisms for implementing selection and compensation.
10. The successful life course is achieved when selection and compensation processes serve to maximize the primary control of the individual over the life course.

Each of the propositions articulated above raises many questions that might guide future research. We focus on four major areas of research that should receive high priority.

Although there exists a wide range of indirect empirical support for selection and compensation processes, direct evidence is lacking. Questionnaire measures of primary and secondary control processes that serve selection and compensation functions need to be developed. Such measures should be validated against behavioral indicators of selection and compensation. One might also ask whether there are interindividual differences in selection and compensation and investigate the extent to which such interindividual differences are stable across the life course.

Biological and sociostructural conditions set age-related constraints on the attainment of various developmental goals. These may be perceived as age-normative deadlines. When approaching such deadlines, the individual needs to increase his or her effort to achieve the selected goal. Once the deadline is passed and the goal has not been achieved, disengagement from the old goal and selection of a new one is required. Otherwise, valuable time, energy, and motivational resources are expended on unattainable goals. This transition from selective primary to compensatory secondary control should be studied.

Another area of study should identify and investigate extreme circumstances in which primary and secondary control processes may be unable to compensate for failures or declines experienced by the individual (Schulz, Heckhausen, & O'Brien, 1994). For example, most older individuals progress through stages of pathology, impairment, and disability before they die. What role do compensation processes play in these transitions and how effective are they in dealing with these threats?

Like some other theories of development (e.g., Werner, 1957), our criteria of success are hierarchically organized and include physical, cognitive, and behavioral components. This is a natural outgrowth of our emphasis on primary control. We would predict, therefore, that threats to higher order criteria such as physical functioning would elicit the strongest compensatory response and would have the greatest negative impact if compensation was unsuccessful.

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