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effects of stressful change, as in families under economic stress (Conger & Elder, 1994; Elder, 1974). Linked lives convey negative and positive emotions. The social regulation, structuring, and support of human lives and development occur in part through multiple, interlocking relationships.

Human Agency, Its Options and Constraints.

The fourth principle reflects an enduring premise of biographical studies on the constructionist role of individuals in shaping their life course. It states that *individuals construct their own life course through the choices and actions they take within the constraints and opportunities of history and social circumstances*. Concepts of human agency have always been prominent in life history studies (Thomas & Znaniecki, 1918–1920), and they are also prominent in the new wave of life course studies that relate individuals to social groups and institutions. People plan and select options that construct their life course within the constraints of particular worlds, ranging from the totalitarian constraints of China's Cultural Revolution to the liberties of Western democracies.

Conclusion

The emergence of life course theory and its elaboration since the 1960s can be viewed in terms of prominent challenges to developmental studies that questioned traditional empirical work and forms of thought. They include the need for life span concepts of development, a way of thinking about lives over time, and connections that link people's lives to the changes in society. Social theories of relationships and age converged in the 1960s with emerging concepts of life-span development to produce a theoretical orientation to the life course, as defined by principles of historical time and place, the timing of lives, linked or interdependent lives, and human agency. Building upon a wide net of cross-disciplinary scholarship in developmental science, distinctions of time, context, and process have become central to a life course theory of child, adolescent, and human development.

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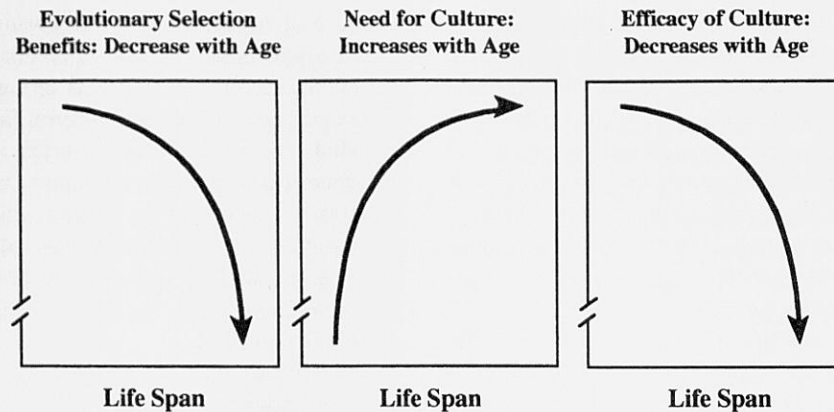
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Glen H. Elder, Jr.

LIFE SPAN PSYCHOLOGY THEORY. The theory of life span psychology structures the study of individual development (ontogenesis) from conception into old age. According to life span psychology theory, development is not completed at adulthood but extends across the life course. Across the life span, adaptive processes of acquisition, maintenance, transformation, and attrition in psychological structures and functions take place. As a consequence, the ontogenesis of mind and behavior is lifelong, dynamic, multidimensional, multifunctional, and nonlinear.

Research informed by life span psychology theory is intended to generate knowledge about three components of individual development: (1) interindividual commonalities (regularities) in development; (2) interindividual differences in development; and (3) intraindividual plasticity (malleability) in development. According to life span psychology theory, joint attention to each of these components and the specification of their age-related interplays are the conceptual and methodological foundations of developmental psychology.

On a strategic level, there are two ways to contribute to life span psychology: person centered (holistic) and function centered. The *holistic* approach proceeds from consideration of the person as a system and attempts



LIFE SPAN PSYCHOLOGY THEORY. Figure 1. *Theory of life span psychology.* Schematic representation of the average dynamics between biology and culture across the life span.

to generate a knowledge base about life span development by describing and connecting age periods or states of development into one overall pattern of lifetime individual development. An example would be Erikson's psychosocial theory of life span stages. Often, this holistic approach to the life span is identified with life course psychology. The *function-centered* way to contribute to life span psychology is to focus on a category of behavior or a mechanism such as perception, information processing, action control, attachment, identity, personality traits, and to describe the life span changes in the mechanisms and processes associated with the category selected. Life span psychology theory aims at incorporating both approaches to life span ontogenesis into one conceptual framework.

Historical Background

From the beginning, and contrary to the North American tradition, the German conception of developmental psychology pioneered by Johann Nikolaus Tetens covered the entire life span and, in its emergence, was closely tied to philosophy, humanism, and education (*Bildung*). The *Zeitgeist* was different when developmental psychology emerged as a specialty in North America and other European countries such as England around the beginning of the twentieth century. At that time, the newly developed fields of genetics and biological evolution were at the forefront of ontogenetic thinking. From biology, with its maturation-based concept of growth, may have sprung the dominant American emphasis in developmental psychology on child psychology and child development. As a consequence, in North American psychology strong bifurcations evolved between child developmentalists, adult developmentalists, and gerontologists.

In recent decades, however, life span approaches

have become more prominent in North America for several reasons. First was a concern with life span development in neighboring social-science disciplines, especially sociology. A second factor was the emergence of gerontology as a field of specialization, with its search for the lifelong precursors of aging. A third factor, and a source of rapprochement between child and adult developmentalists, was the aging of several classic longitudinal studies on child development begun in the 1920s and 1930s. In the wake of these developments, the need for better collaboration among all age specialties of developmental scholarship became an imperative of current-day research in developmental psychology.

The Overall Architecture of Life Span Development

Life span psychology theory approaches life span development proceeding from the distal and general to the more proximal and specific. The most general level of analysis concerns the overall biological and cultural architecture of life span development. According to life span psychology theory, the benefits of evolutionary selection decrease with age, the need for culture increases with age, and the efficacy of culture decreases with age (see Figure 1).

Evolutionary Selection Benefits Decrease Across the Life Span. The first component of the tripartite argument derives from an evolutionary perspective on the nature of the genome and its age-correlated changes in expressivity and biological potential. During evolution, the older the organism, the less the genome benefited from the genetic advantages associated with evolutionary selection. In other words, the benefits resulting from evolutionary selection display a negative age correlation. Certainly after maturity, and with age,

the expressions and mechanisms of the genome lose in functional quality. This general statement holds true even though some indirect positive evolutionary selection benefits are carried into old age (e.g., through grandparenting). The age-associated diminution of evolutionary selection benefits and its implied association with an age-related loss of biological potential is further affected by the fact that in earlier times few people reached old age, and by other aspects of the biology of aging (e.g., wear-and-tear).

Age-Related Increase in Need for Culture. The middle part of Figure 1 summarizes the overall perspective on life span development associated with culture and culture-based processes. Here, culture refers to all the psychological, social, material, and symbolic (knowledge-based) resources that humans have produced over the millennia. Among these cultural resources are cognitive skills, motivational dispositions, socialization strategies, literacy, written documents, physical structures, and the world of economics as well that of medical and physical technology.

The argument for an age-related increase in the "need" for culture has two parts. First, for human ontogenesis to have reached increasingly high levels of functioning, whether in physical or psychological domains, there had to be a conjoint evolutionary increase in the richness and dissemination of the resources and "opportunities" of culture. The second argument for the proposition relates to the biological weakening associated with age. That is, the older we are, the more we need culture-based resources (material, social, economic, psychological) to generate and maintain high levels of functioning. A case in point is that for cognitive efficacy to continue into old age at comparable levels of performance, more cognitive support and training are necessary.

One illustration of the age-related increase in culture is the notion of age-graded developmental tasks proposed by Robert Havighurst. In this view, the life span is constituted by a series of contextualized challenges, or life span goals (e.g., education, work, family, citizenship, retirement, dying and death). To achieve these goals, social institutions and other forms of cultural support are necessary. Currently, a gap exists between the general desirability of these goals and the institutional support structure facilitating their attainment. As emphasized by the life span sociologist Matilda Riley, this gap is especially large for old age. For instance, although spirituality and wisdom are widely accepted goals of late life, the social conditions in support of their achievement are restricted to a small segment of the population.

Age-Related Decrease in Efficiency of Culture. The third cornerstone of the overall nature of life span development is the life span script of a decreasing efficiency of cultural factors and resources. During the

second half of life, despite the advantages associated with the developmental acquisition of knowledge-based mental representations, there is an age-associated reduction in the efficiency of cultural factors. The older the adult, the more time and practice it takes to attain the same learning gains. Moreover, at least in some domains of information processing, and when it comes to high levels of performance, older adults may not be able to reach the same levels of functioning as younger adults, even after extensive training and under positive life circumstances.

There are at least three causes for this age-related reduction in cultural efficiency. The first is age-related loss in biological potential. The second can be seen by viewing the life course as in an analogy to a learning curve. In agreement with the experimentally observed reduction of gains in later phases of learning, ontogenetic performance increments become increasingly difficult to achieve when high levels of functioning have been reached, and often require added effort or improvements in technology. The third reason refers to the possibility of age-related increases in negative transfer and costs of specialized knowledge.

The three conditions and trajectories outlined in Figure 1 form a robust and interrelated fabric (architecture) of the life span dynamics between biology and culture. For evolutionary and historical reasons, the ontogenetic structure of the life course displays a kind of unfinished architecture. Whatever the specific content and form of a given psychological theory of life span development, it needs to be consistent with the framework outlined.

Life Span Changes in Relative Resource Allocation

One way to categorize the implications of the overall architecture is to distinguish between three goals of ontogenetic development: growth, maintenance (including resilience), and the regulation of loss. The allocation of available resources for growth decreases with age, whereas investments into maintenance and regulation of loss increase with age. Growth refers to behaviors aimed at reaching higher levels of functioning or adaptive capacity. Maintenance refers to behaviors aimed either at maintaining levels of functioning in the face of a new challenge or at returning to previous levels after a loss. Regulation of loss refers to behaviors that organize adequate functioning at lower levels when maintenance or recovery—for instance because of external or internal losses in resources—is no longer possible.

Life span psychology theory posits that the life span shift in the relative allocation of resources, away from growth toward the goals of maintenance and the regulation of loss, is a critical issue for any theory of life span development. Due in part to this shift, the attain-

ment of positive developmental outcomes is inherently and increasingly tied to recognizing and managing generational turnover as well as managing or becoming reconciled to one's biological losses, finitude, and impending death.

In addition, life span psychology emphasizes the dynamics between the life span trajectories of growth, maintenance, and regulation. The mastery of life often involves conflicts and competition among these three developmental goals. Consider, for example, the interplay between autonomy and dependence in children and older adults. Whereas the primary focus of the first half of life is the maximization of independence and autonomy, the goal-profile changes in old age. The productive and creative use of dependence rather than independence becomes critical. By invoking dependence and support, older people free up resources for use in other domains involving personal efficacy and growth.

The age-related weakening of the biological foundation and the change in the overall life span script associated with growth, maintenance, and regulation of loss does not imply that there is no opportunity for growth at all in the second half of life. Deficits in biological status can also be the foundation for progress; that is, antecedents for positive changes in adaptive capacity. The most radical view of this proposition is contained in the notion of "culture as compensation." Under the influence of cultural-anthropological as well as evolutionary biological arguments, researchers have recognized that suboptimal biological states or imperfections are catalysts for the evolution of culture and for advanced states achieved in human ontogeny.

Metatheoretical Propositions of Life Span Theory

Life span psychology highlights the need to overcome linear, unidimensional, unidirectional, and unifunctional conceptions of development, which had flourished in conjunction with the traditional biological conceptions of growth or physical maturation. In these traditional conceptions, attributes such as qualitative change, ordered sequentiality, irreversibility, and the definition of an end state were critical. Considering evolutionary perspectives, neofunctionalism, and contextualism, life span psychology theory treats developing systems as multidimensional, multifunctional, and dynamic, with different domains and functions developing in a less than fully integrated manner, and with trade-offs between functional advances and discontinuities between age levels being the rule rather than the exception.

Relatedly, development is seen as always being constituted by gains and losses. Important evidence for this view are the diverging life span trajectories proposed and observed for various components of intelligence. For instance, gains in the knowledge-based pragmatics

and losses in the basic mechanics of intelligence coexist during large portions of the life span. The coexistence of gains and losses is further supported by the open systems view of the incomplete biological and cultural architecture of life span development and the multiple ecologies of life, which render it impossible to posit a single end state to development. Given the complex and changing nature of the criteria involved in everyday adaptation, the capacity to move between levels of knowledge and skills rather than to operate at one specific developmental level of functioning appears crucial for effective individual development. Finally, the dynamics between gains and losses are highlighted by the phenomenon of negative transfer associated with the evolution of any form of specialization or expertise, and by the notion of equifinality, which states that the same developmental outcome (e.g., high levels of subjective well-being) can be reached by different means and combination of means. Based on all of these considerations, life span psychology theory rejects the view of development as universal growth as theoretically false and empirically inappropriate.

Another tenet of life span psychology theory deals with the structural composition of the factors that influence and regulate development across the life span. Three sources of influence are distinguished: age-graded, history-graded, and idiosyncratic. Within each source, both biological and cultural causal mechanisms are present. The composition and level of these sources vary across individuals as a function of factors such as genome, gender, social class, and ethnicity. Thus, life span psychology theory portrays life courses as dynamic constellations of age-graded, history-graded, and idiosyncratic influences. As Richard Lerner and Sandra Scarr have emphasized, this includes individuals' own proactive and reactive behaviors and actions.

A Systemic Theory of Life Span Development: Selective Optimization with Compensation

During the 1990s, several efforts at theoretical development in life span psychology emanated from both researchers on childhood and adolescence as well as the community of researchers on aging. Given the emphasis of life span psychology theory on exploring consistency and fertility between levels of analysis, we restrict our presentation to the theory of selective optimization with compensation (SOC theory) developed by Margret Baltes, Paul Baltes, and their colleagues.

A specific example may help to clarify the meaning of the three processes. When the concert pianist Artur Schnabel, as an 80-year-old, was asked in a television interview how he managed to maintain such a high level of expert piano playing, he hinted at the coordination of three strategies. First, he played fewer pieces

(selection); he practiced these pieces more often (optimization); and to counteract his loss in mechanical speed he now used a kind of impression management, such as playing more slowly before fast segments to make the latter appear faster (compensation).

Selective optimization with compensation theory combines the overall framework of life span psychology with process-oriented psychological research and theorizing. It defines successful development as the conjoint maximization of gains (desirable goals or outcomes) and the minimization of losses (undesirable goals or outcomes). The nature of what constitutes gains and losses, and of the dynamic between gains and losses, is conditioned by cultural and personal factors as well as by the position in the lifetime of an individual.

Selection deals with goals or outcomes of development, optimization with the enhancement of means to reach goals, and compensation with the generation of new means (e.g., hearing aids) in order to maintain a given level of goal achievement. According to selective optimization with compensation theory, each developmental process and outcome can be decomposed into aspects of selection, optimization, and compensation.

Selective optimization with compensation theory is both universal and relativistic. In its metatheoretical universality, and without specifying the substantive goals and outcomes of development (which will vary according to theoretical framework, substantive research area, and level of analysis), it postulates that any process of human development involves an orchestration of selection, optimization, and compensation. Selective optimization with compensation theory also states that the coordinated orchestration of these three processes results in desired while minimizing undesirable developmental outcomes.

However, the concrete specification of selective optimization with compensation processes is person-specific and contextually bound. Thus, as the theoretical model is applied to specific domains and contexts of psychological functioning (such as control, autonomy, and professional expertise, or to different cultural contexts), it requires further specification to be derived from the knowledge base of the domain of functioning selected for application and for the context in which this phenomenon is embedded.

Methodological Advances

Metatheory and methodology have been closely intertwined since the very early origins of life span psychology (e.g., Quetelet, 1842; Tetens, 1777), and the search for methods adequate for the study of developmental processes is a continuing part of the agenda of life span psychology. Four examples are provided below. A first methodological development concerns methods to organize and study the temporal flow, antecedents,

and correlates of life events including death. Life-course sociologists, in particular, have made major contributions to the advancement of this methodology. Among the relevant methods, models of event-history analysis and associated methods such as hazard rate and survival analysis are especially important.

A second example of methodological innovations involves a strategy to examine the scope and limits of plasticity. This method is similar to efforts in child development to study the zone of proximal development through methods of microgenetic analysis or cognitive engineering. Because of the long time frame of life span ontogenesis, it is difficult to identify the sources and scope of plasticity and its age-related changes. At the same time, the inquiry into what is possible in principle in human development across the life span is important. For instance, cognitive aging researchers want to know whether aging losses in functions reflect experiential practice deficits rather than effects of biological aging. To explore this issue, testing-the-limits research attempts to compress time by providing for high-density developmental experiences in order to identify asymptotes of performance potential (plasticity). These asymptotes, obtained under putatively optimal conditions of support, are expected to estimate the upper range of age-specific developmental potential.

A third example is the use of experimental simulation. The two key features of this method are the search for causal mechanisms through the arrangement of experimental conditions that mimic (simulate) variations in developmental phenomena, and the subsequent evaluation of the evidence in naturalistic settings.

A fourth example for methodological developments closely related to life span psychology theory concerns research designs aimed at discriminating among varieties of environmental change, such as enduring differences between people born at different points in historical time (cohort effects); specific influences of historical events across chronological age (period effects); or generalized and enduring shifts in the environment affecting individuals of all ages and subsequent cohorts (general environmental change).

Conclusion

In developing and refining its multilevel framework life span psychology theory has benefited much from transdisciplinary dialogue, especially with modern developmental biologists but also with sociologists and cultural psychologists. Biologists, for instance, contributed in major ways in moving research away from unilinear, unifunctional, and deterministic models of ontogenesis to a theoretical framework that highlights the contextual, adaptive, probabilistic, and self-organizational dynamic aspects of ontogenesis. Similarly, sociologists and cultural psychologists have demonstrated that the ar-

chitecture of human development is essentially incomplete because of the multitude of culturally engineered developmental pathways and endpoints. For life span development to extend into later stages of life, the role of adequate institutional and technological support is critical. In this regard, old age is young.

The future of life span psychology theory will depend significantly on the extent to which its meta-theoretical and empirical perspectives turn out to be productive not only for the conduct of developmental research, but also for other psychological specialties such as clinical, cognitive, educational, social, personality, and applied psychology. The interconnections with other psychological specialties will be the final testing ground of what life span theory and research has to offer to psychology, as a science and as a profession.

[See also Adulthood and Aging; and Developmental Psychology.]

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Ulman Lindenberger and Paul B. Baltes

LIFE SPAN STAGES. See the biography of Erikson.

LIKERT SCALE. Investigators are able to assess people's attitudes toward an issue or outcome through the use of a Likert scale. People indicate their level of agreement with a series of opinion statements, and these ratings are summed to provide a measure of their attitude. For example, a Likert scale that measures attitudes toward genetic testing might require people to rate the extent to which they agree or disagree with statements such as "Genetic testing will result in discrimination against people based on their genes," and "Genetic testing will increase the chances that health problems can be treated early." Because a person's attitude is based on the sum of his or her ratings on