Select one of the perspectives identified in the Theoretical Perspectives to Understand Human Development document and identify one theory (Freud's Psychosexual Theory, Erikson's Psychosocial Theory, etc.) that you would like to explore more.

Explain the theory you selected providing a well-developed overview. In addition, research one peer-reviewed article from your selected theoretical perspective in the Ashford University Library. Summarize the article being sure to include research question(s) and/or problem(s), target population and sample (specific group within the target population), measures (tests, instruments, and/or questionnaires used), procedures (how the study was conducted), and conclusions presented in the article. Analyze the ethical considerations, as well as the benefits and limitations of the research proposing solutions or suggestions for any issues or concerns.

THEORETICAL PERSPECTIVES TO UNDERSTAND HUMAN DEVELOPMENT & GUIDE

PERSPECTIVE	NOTABLE THEORIES/EXAMPLES THAT ALIGN	MAIN IDEA	BIOPSYCHOSOCIAL EMPHA (Biopsychosocial = the interacting of sociocultural, and psychological forces or
Psychodynamic	• Sigmund Freud, Psychosexual Theory • Erik Erikson, Psychosocial Theory	• In both theories, development occurs across a sequence of stages	• Both theories emphasize psycholo and life-cycle forces as crucial in de
Learning	• Behaviorism (John B. Watson, B.F. Skinner)	• Environment controls behavior	• In all theories, some emphasis on and psychological factors, but mos on social
	• Social Learning Theory (Albert Bandura)	• People learn through observation & interaction	
Cognitive	• Piaget's Theory of Cognitive Development (Jean Piaget)	• For Piaget & Kohlberg development occurs across a sequence of stages	• For Piaget & Kohlberg the main em placed on biological and social for
	• Kohlberg's Theory of Moral Development (Lawrence Kohlberg)		
	• Vygotsky's Sociocultural Theory (Lev Vygotsky)	• Development is influenced by culture	• Emphasis is placed on psychologic forces
Ecological	• Ecological Systems Theory (Urie Bronfenbrenner)	• Developing person is embedded in a series of interacting systems	• Heavy emphasis is placed on socia
Humanistic	• Carl Rogers; Abraham Maslow	• Emphasizes free will and the ability of humans to make choices about their life.	• Rejects the idea that behavior is d unconscious processes, learning fr environment, or cognitive process people make their own choices ab

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Theoretical Propositions of Life-Span Developmental Psychology: On the Dynamics Between Growth and Decline

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Life-span developmental psychology involves the study of constancy and change in behavior throughout the life course. One aspect of life-span research has been the advancement of a more general, metatheoretical view on the nature of development. The family of theoretical perspectives associated with this metatheoretical view of life-span developmental psychology includes the recognition of multidirectionality in ontogenetic change, consideration of both age-connected and disconnected developmental factors, a focus on the dynamic and continuous interplay between growth (gain) and decline (loss), emphasis on historical embeddedness and other structural contextual factors, and the study of the range of plasticity in development. Application of the family of perspectives associated with life-span developmental psychology is illustrated for the domain of intellectual development. Two recently emerging perspectives of the family of beliefs are given particular attention. The first proposition is methodological and suggests that plasticity can best be studied with a research strategy called testing-the-limits. The second proposition is theoretical and proffers that any developmental change includes the joint occurrence of gain (growth) and loss (decline) in adaptive capacity. To assess the pattern of positive (gains) and negative (losses) consequences resulting from development, it is necessary to know the criterion demands posed by the individual and the environment during the lifelong process of adaptation.

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The study of life-span development is not a homogeneous field. It comes in two major interrelated modes. The first mode is the extension of developmental studies across the life course without a major effort at the construction of metatheory that emanates from life-span work. The second mode includes the endeavor to explore whether life-span research has specific implications for the general nature of developmental theory. The second approach represents the topic of this article.

Specifically, the purpose of this article is twofold. First, after a brief introduction to the field of life-span developmental psychology, some "prototypical" features of the life-span approach in developmental psychology are presented. Second, these features are illustrated by work in one domain: intellectual development. Although the focus of this paper is on life-span developmental psychology and its theoretical thrust, it is important to recognize at the outset that similar perspectives on developmental theory have been advanced in other quarters of developmental scholarship as well (Hetherington & Baltes, in press; Scarr, 1986). There is, however, a major difference in the "gestalt" in which the features of the theoretical perspective of life-span psychology are organized.

Several, if not most, of the arguments presented here are consistent with earlier publications by the author and others on the field of life-span developmental psychology (Baltes, 1983; Baltes & Reese, 1984; Featherman, 1983; Honzik, 1984; Lerner, 1984; Sherrod & Brim, 1986). This article includes two added emphases. First, it represents an effort to illustrate the implications of the theoretical perspectives associated with life-span work for research in cognitive development. Second, two of the more recent perspectives derived from life-span work are given special attention. The first is that *any* process of development entails an inherent dynamic between gains and losses. According to this belief, no process of development consists only of growth or progression. The second proposition states that the range of plasticity can best be studied with a research strategy called *testing-the-limits*.

What is Life-Span Development?

Life-span developmental psychology involves the study of constancy and change in behavior throughout the life course (ontogenesis), from conception to death.[1] The goal is to obtain knowledge about general principles of life-long development, about interindividual differences and similarities in development, as well as about the degree and conditions of individual plasticity or modifiability of development (Baltes, Reese, & Nesselroade, 1977; Lerner, 1984; Thomae, 1979).

This article is based on invited addresses to Division 7 of the American Psychological Association (Toronto, Canada, August 1984) and to the International Society for the Study of Behavioral Development (Tours, France, July 1985).

Helpful suggestions by Michael Chapman and many valuable discussions with members of the Social Science Research Council Committee on Life-Course Perspectives in Human Development are acknowledged.

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[1] In this article, the terms *life span* and *life course* are used interchangeably. Since the origin of the West Virginia Conference Series (Goulet & Baltes, 1970), psychologists tend to prefer *life span* (see, however, Bühler, 1933), whereas sociologists lean toward the use of the term *life course*.

It is usually assumed that child development, rather than life-span development, was the subject matter of the initial scholarly pursuits into psychological ontogenesis. Several historical reviews suggest that this generalization is inaccurate (Baltes, 1983; Groffmann, 1970; Reinert, 1979). The major historical precursors of scholarship on the nature of psychological development—by Tetens in 1777, Carus in 1808, Quetelet in 1835—were essentially life-span and not child-centered in approach. Despite these early origins of life-span thinking, however, life-span development has begun to be studied empirically only during the last two decades by researchers following the lead of early twentieth century psychologists such as Charlotte Bühler (1933), Erik H. Erikson (1959), G. Stanley Hall (1922), H. L. Hollingworth (1927), and Carl G. Jung (1933).

Three events seem particularly relevant to the more recent burgeoning of interest in life-span conceptions: (a) population demographic changes toward a higher percentage of elderly members; (b) the concurrent emergence of gerontology as a field of specialization, with its search for the life-long precursors of aging (Birren & Schaie, 1985); and (c) the "aging" of the subjects and researchers of the several classical longitudinal studies on child development begun in the 1920s and 1930s (Migdal, Abeles, & Sherrod, 1981; Verdonik & Sherrod, 1984). These events and others have pushed developmental scholarship toward recognizing the entire life span as a scientifically and socially important focus.

Added justification for a life-span view of ontogenesis and important scholarly contributions originate in other disciplines as well. One such impetus for life-span work comes from sociology and anthropology (Bertaux & Kohli, 1984; Brim & Wheeler, 1966; Clausen, 1986; Dannefer, 1984; Elder, 1985; Featherman, 1983; Featherman & Lerner, 1985; Kertzer & Keith, 1983; Neugarten & Datan, 1973; Riley, 1985; Riley, Johnson, & Foner, 1972). Especially within sociology, the study of the life course and of the interage and intergenerational fabric of society is enjoying a level of attention comparable with that of the life-span approach in psychology.

Another societal or social raison d'être for the existence of life-span interest is the status of the life course in longstanding images that societies and their members hold about the life span (Philibert, 1968; Sears, 1986). In the humanities, for example, life-span considerations have been shown to be part of everyday views of the structure and function of the human condition for many centuries. The Jewish Talmud, Greek and Roman philosophy (e.g., the writings of Solon and Cicero), literary works such as those of Shakespeare, Goethe, or Schopenhauer, all contain fairly precise images and beliefs about the nature of life-long change and its embeddedness in the age-graded structure of the society. Particularly vivid examples of such social images of the life span come from the arts. During the last centuries, many works of art were produced, reproduced, and modified in most European countries, each using stages, steps, or ladders as a framework for depicting the human life course (Joerißen & Will, 1983; Sears, 1986).

These observations on literature, art history, and social images of the life course suggest that the field of life-span development is by no means an invention of developmental psychologists. Rather, its recent emergence in psychology reflects the perhaps belated effort on the part of psychologists to attend to an aspect of the human condition that is part and parcel of our everyday cultural knowledge systems about living organisms. Such social images suggest that the life course is something akin to a natural, social category of knowledge about ontogenesis and the human condition.

Is Life-Span Development a Theory or a Field of Specialization?

What about the theoretical spectrum represented by life-span developmental psychology? Is it a single theory, a collection of subtheories, or just a theoretical orientation? Initial interest often converges on the immediate search for one overarching and unifying theory such as Erikson's (1959). The current research scene suggests that in the immediate future life-span developmental psychology will not be identified with a single theory. It is above all a subject matter divided into varying scholarly specializations. The most general orientation toward this subject matter is simply to view behavioral development as a life-long process.

Such a lack of theoretical specificity may come as a surprise and be seen as a sign that the life-span perspective is doomed. In fact, the quest for a single, good theory (and the resulting frustration when none is offered) is an occasional challenge laid at the doorsteps of life-span scholars (Kaplan, 1983; Scholnick, 1985; Sears, 1980). Note, however, that the same lack of theoretical specificity applies to other fields of developmental specialization. Infant development, child development, gerontology, are also not theories in themselves, nor should one expect that there would be a single theory in any of these fields. In fact, as long as scholars look for *the* theory of life-span development they are likely to be disappointed.

A Family of Perspectives Characterizes the Life-Span Approach

Much of life-span research proceeds within the theoretical scenarios of child developmental or aging work. In addition, however, efforts have been made by a fair number of life-span scholars to examine the question of whether life-span research suggests a particular metatheoretical world view (Reese & Overton, 1970) on the nature of development. The theoretical posture proffered by this endeavor is the focus of the remainder of this article.

For many researchers, the life-span orientation entails several prototypical beliefs that, in their weighting and coordination, form a *family of perspectives* that together specify a coherent metatheoretical view on the nature of development. The significance of these beliefs lies not in the individual items but in the pattern. Indeed, none of the individual propositions taken separately is new, which is perhaps one reason why some commentators have argued that life-span work has little new to offer (Kaplan, 1983). Their significance consists instead in the whole complex of perspectives considered as a metatheoretical world view and applied with some degree of radicalism to the study of development.

What is this family of perspectives, which in their coordinated application characterizes the life-span approach? Perhaps no single set of beliefs would qualify in any definite sense. However, the beliefs summarized in Table 1 are likely to be shared by many life-span scholars. They can be identified pri-

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Table 1
Summary of Family of Theoretical Propositions Characteristic of Life-Span Developmental Psychology

Concepts	Propositions
Life-span development	Ontogenetic development is a life-long process. No age period holds supremacy in regulating the nature of development. During development, and at all stages of the life span, both continuous (cumulative) and discontinuous (innovative) processes are at work.
Multidirectionality	Considerable diversity or pluralism is found in the directionality of changes that constitute ontogenesis, even within the same domain. The direction of change varies by categories of behavior. In addition, during the same developmental periods, some systems of behavior show increases, whereas others evince decreases in level of functioning.
Development as gain/loss	The process of development is not a simple movement toward higher efficacy, such as incremental growth. Rather, throughout life, development always consists of the joint occurrence of gain (growth) and loss (decline).
Plasticity	Much intraindividual plasticity (within-person modifiability) is found in psychological development. Depending on the life conditions and experiences by a given individual, his or her developmental course can take many forms. The key developmental agenda is the search for the range of plasticity and its constraints.
Historical embeddedness	Ontogenetic development can also vary substantially in accordance with historical–cultural conditions. How ontogenetic (age-related) development proceeds is markedly influenced by the kind of sociocultural conditions existing in a given historical period, and by how these evolve over time.
Contextualism as paradigm	Any particular course of individual development can be understood as the outcome of the interactions (dialectics) among three systems of developmental influences: age-graded, history-graded, and nonnormative. The operation of these systems can be characterized in terms of the metatheoretical principles associated with contextualism.
Field of development as multidisciplinary	Psychological development needs to be seen in the interdisciplinary context provided by other disciplines (e.g., anthropology, biology, sociology) concerned with human development. The openness of the life-span perspective to interdisciplinary posture implies that a "purist" psychological view offers but a partial representation of behavioral development from conception to death.

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marily from the writings in psychology on this topic (Baltes & Reese, 1984; Baltes, Reese, & Lipsitt, 1980; Lerner, 1984; Sherrod & Brim, 1986), but they are also consistent with sociological work on the life course (Elder, 1985; Featherman, 1983; Riley, 1985).

The family of beliefs will be illustrated below, primarily using the study of intellectual development as the forum for exposition. Because, historically, the period of adulthood was the primary arena of relevant research, that age period receives most coverage. It will also be shown, however, that the metatheoretical posture may shed new light on intellectual development in younger age groups as well.

Empirical Illustration: Research on Intellectual Development

The area of intellectual functioning is perhaps the best studied domain of life-span developmental psychology. The discussion and elaboration of the empirical and conceptual bases of the family of perspectives presented here is selective. The intent is not to be comprehensive but to offer examples of areas of research. (Different research findings and agendas—see, for instance, Keating & MacLean, in press; Perlmutter, in press; Sternberg, in press, for other similar efforts—could have been used were it not for the particular preferences of the author.) More detailed information on the topic of life-span intelligence is contained in several recent publications (Baltes, Dittmann-Kohli, & Dixon, 1984; Berg & Sternberg, 1985; Denney, 1984; Dixon & Baltes, 1986; Labouvie-Vief, 1985; Perlmutter, in press; Rybash, Hoyer, & Roodin, 1986; Salthouse, 1985).

Intellectual Development Is a Life-Long Process Involving Multidirectionality

The first two of the family of perspectives (see Table 1) state that behavior-change processes falling under the general rubric of development can occur at any point in the life course, from conception to death. Moreover, such developmental changes can display distinct trajectories as far as their directionality is concerned.

Life-long development. The notion of life-long development implies two aspects. First, there is the general idea that development extends over the entire life span. Second, there is the added possibility that life-long development may involve processes of change that do not originate at birth but lie in later periods of the life span. Considered as a whole, life-long development is a system of diverse change patterns that differ, for example, in terms of timing (onset, duration, termination), direction, and order.

One way to give substance to the notion of life-long development is to think of the kinds of demands and opportunities that individuals face as they move through life. Havighurst's (1948/1972; Oerter, 1986) formulation of the concept of developmental tasks is a useful aid for grasping the notion of a life-long

system of demands and opportunities. Developmental tasks involve a series of problems, challenges, or life-adjustment situations that come from biological development, social expectations, and personal action. These problems "change through life and give direction, force, and substance to . . . development." (Havighurst, 1973, p. 11).

Thus, the different developmental curves constitutive of lifelong development can be interpreted to reflect different developmental tasks. Some of these developmental tasks—like Havighurst's conception—are strongly correlated with age. However, as will be shown later, such developmental tasks are also constituted from certain historical and nonnormative systems of influence.

Multidimensionality and multidirectionality. The terms *multidimensionality* and *multidirectionality* are among the key concepts used by life-span researchers to describe facets of plurality in the course of development and to promote a concept of development that is not bound by a single criterion of growth in terms of a general increase in size or functional efficacy.

Research on psychometric intelligence illustrates the usefulness of multidimensional and multidirectional conceptions of development. The psychometric theory of fluid-crystallized intelligence proposed by Cattell (1971) and Horn (1970, 1982) serves as an example (Figure 1). First, according to this theory, intelligence consists of several subcomponents. Fluid and crystallized intelligence are the two most important clusters of abilities in the theory. The postulate of a system of abilities is an example of multidimensionality. Second, these multiple-ability components are expected to differ in the direction of their development. Fluid intelligence shows a turning point in adulthood (toward decline), whereas crystallized intelligence exhibits the continuation of an incremental function. This is an example of the multidirectionality of development.

Meanwhile, the Cattell-Horn theoretical approach to life-span intellectual development has been supplemented with other conceptions, each also suggesting the possibility of multidimensional and multidirectional change. Berg and Sternberg (1985), for example, have examined the implications of Sternberg's triarchic theory of intelligence for the nature of life-long development. They emphasized that the age trajectories for the three postulated components of Sternberg's theory of intelligence (componential, contextual, experiential) are likely to vary in directionality.

Current work on life-span intelligence (Baltes et al., 1984; Dixon & Baltes, 1986) has also expanded on the Cattell–Horn model by linking it to ongoing work in cognitive psychology. Two domains of cognitive functioning are distinguished in a dual-process scheme: the "fluid" mechanics and the "crystallized" pragmatics of intelligence. The *mechanics of intelligence* refers to the basic architecture of information processing and problem solving. It deals with the basic cognitive operations and cognitive structures associated with such tasks as perceiving relations and classification. The second domain of the dual-process scheme, the *pragmatics of intelligence*, concerns the context- and knowledge-related application of the mechanics of intelligence. The intent is to subsume under the pragmatics of intelligence (a) fairly general systems of factual and procedural knowledge, such as crystallized intelligence; (b) specialized systems of factual and procedural knowledge, such as occupational expertise; and (c) knowledge about factors of performance, that is, about skills relevant for the activation of intelligence in specific contexts requiring intelligent action. The explicit focus on the pragmatics of intelligence demands (like Sternberg's concern with contextual and experiential components) a forceful consideration of the changing structure and function of knowledge systems across the life span (see also Featherman, 1983; Keating & MacLean, in press; Labouvie-Vief, 1985; Rybash et al., 1986).

New forms of intelligence in adulthood and old age? What about the question of later-life, "innovative" emergence of new forms of intelligence? It is one thing to argue in principle that new developmental acquisitions can emerge at later points in life with relatively little connection to earlier processes and quite another to demonstrate empirically the existence of such innovative, developmentally late phenomena. A classic example used by life-span researchers to illustrate the developmentally late emergence of a cognitive system is the process of reminiscence and life review (Butler, 1963). The process of reviewing and reconstructing one's life has been argued to be primarily a late-life phenomenon. The phenomenon of autobiographical memory is another example (Strube, 1985).

For the sample case of intelligence, it is an open question whether adulthood and old age bring with them new forms of directionality and intellectual functioning, or whether continuation and quantitative (but not qualitative) variation of past functioning is the gist of the process. On the one hand, there are Flavell's (1970) and Piaget's (1972) cognitive-structuralist accounts, which favor an interpretation of horizontal *décalage* rather than one of further structural evolution or transformation. These authors regard the basic cognitive operations as fixed by early adulthood. What changes afterwards is the content domains to which cognitive structures are applied.

On the other hand, there are very active research programs engaged in the search for qualitatively or structurally new forms of adult intelligence (Commons, Richards, & Armon, 1984). The work on dialectical and postformal operations by Basseches (1984), Labouvie-Vief (1982, 1985), Kramer (1983), Pascual-Leone (1983), and other related writings (e.g., Keating & MacLean, in press) are notable examples of this effort. This line of scholarship has been much stimulated (or even launched) by Riegel's work on dialectical psychology and his outline of a possible fifth stage of cognitive development (Riegel, 1973, 1976).

Other work on adult intellectual development proceeds from a neofunctionalist perspective (Beilin, 1983; Dixon & Baltes, 1986) and is informed by work in cognitive psychology. Models of expertise (Glaser, 1984) and knowledge systems (Brown, 1982) guide this approach in which the question of structural stages is of lesser significance. Aside from an interest in the aging of the "content-free" mechanics of intelligence (Kliegl & Baltes, in press), the dominant focus is on changes in systems of factual and procedural knowledge associated with the "crystallized" pragmatics of intelligence. The crystallized form of intelligence was highlighted already as an ability cluster exhibiting stability or even positive changes into late adulthood. The concept of crystallized intelligence, however, needs further expansion to cover additional domains of knowledge and to permit consideration of forms of knowledge more typical of the second half of life.

Expertise, a concept currently in vogue in cognitive and developmental psychology (Ericsson, 1985; Glaser, 1984; Hoyer,

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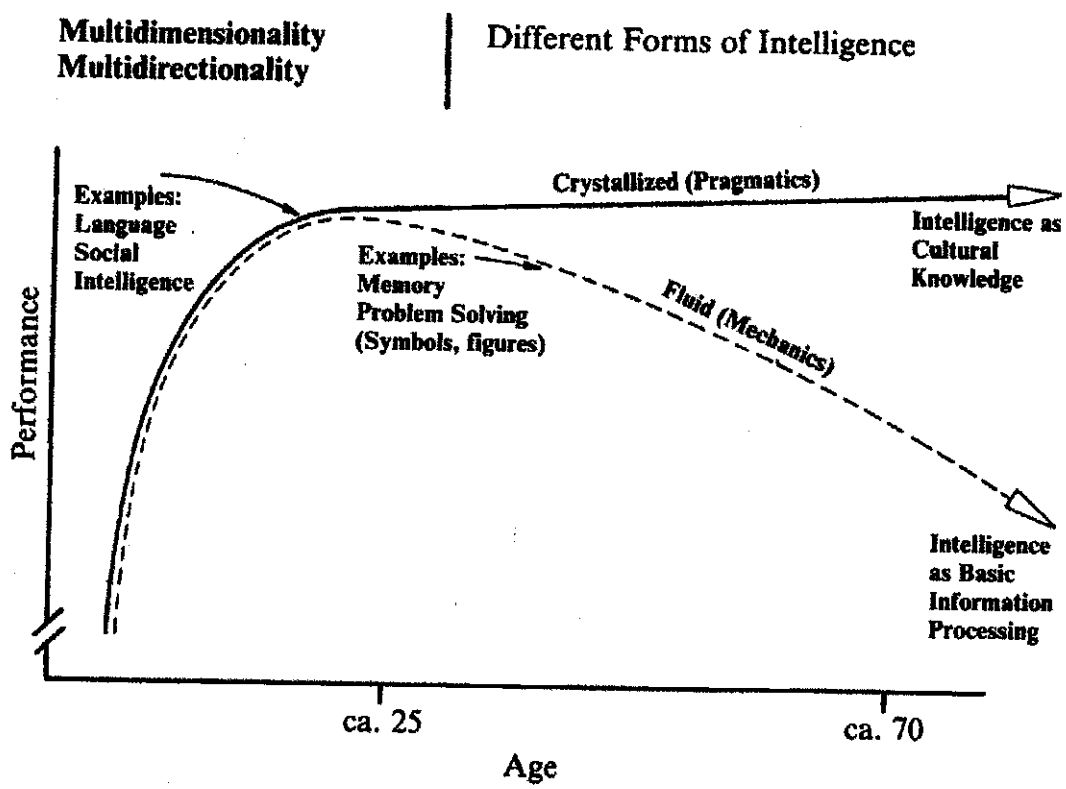

Figure 1. One of the best known psychometric structural theories of intelligence is that of Raymond B. Cattell and John L. Horn. (The two main clusters of that theory, fluid and crystallized intelligence, are postulated to display different life-span developmental trajectories.)

1985; Weinert, Schneider, & Knopf, in press), can be used to illustrate this avenue of research. This concept denotes skills and knowledge that are highly developed and practiced. The sciences, chess, or job-related activities (e.g., typing) are often used as substantive domains in which performance in relation to the acquisition and maintenance of expertise is studied. The life course of many individuals most likely offers opportunity for the practice of such forms of expertise. Therefore, one would expect that further growth of intellectual functioning may occur in those domains in which individuals continue to practice and evolve their procedural and factual knowledge (Denney, 1984; Dixon & Baltes, 1986; Hoyer, 1985; Rybash et al., 1986). In other words, expertise in select facets of the pragmatics of intelligence can be maintained, transformed, or even newly acquired in the second half of life if the conditions are such that selective optimization in the associated knowledge system can occur.

Two areas of knowledge have been identified as key candidates for domains in which the pragmatics of intelligence may exhibit positive changes during the second half of life: practical intelligence (Sternberg & Wagner, 1986) and knowledge about the pragmatics of life, such as is evident in research on social intelligence and wisdom (Clayton & Birren, 1980; Dittmann-Kohli & Baltes, in press; Holliday & Chandler, 1986; Meacham, 1982). Wisdom, in particular, has been identified as a prototypical or exemplar task of the pragmatics of intelligence that may exhibit further advances in adulthood or whose origins may lie primarily in adulthood.

In one approach (Dittmann-Kohli & Baltes, in press; Dixon & Baltes, 1986; Smith, Dixon, & Baltes, in press), wisdom is defined as an "expertise in the fundamental pragmatics of life." In order to capture wisdom, subjects of different age groups are asked, for example, to elaborate on everyday problems of life planning and life review. The knowledge system displayed in protocols of life planning and life review is scored against a set of criteria derived from the theory of wisdom. First evidence (Smith et al., in press) suggests, as expected by the theory, that some older adults indeed seem to have available a well-developed system of knowledge about situations involving questions of life planning. For example, when older adults are asked to explore a relatively rare or odd life-planning situation involving other older persons, they demonstrate a knowledge system that is more elaborated than that of younger adults.

The study of wisdom is just beginning. Thus, it is still an open question whether the concept of wisdom can be translated into empirical steps resulting in a well-articulated psychological theory of wisdom. We are somewhat optimistic, inasmuch as cognitive psychologists are increasingly studying tasks and reasoning problems that, like the problems to which wisdom is applied, have a high degree of real-life complexity, and whose problem definition and solution involve uncertainty and relativism in judgment (Dörner, in press; Neisser, 1982). In the present context, the important point is that research on wisdom is an illustration of the type of knowledge systems that developmental, cognitive researchers are beginning to study as their attention is focused on later periods of life.

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Intellectual Development as a Dynamic Between Growth (Gain) and Decline (Loss)

The next belief (see Table 1) associated with life-span work is the notion that any process of development entails aspects of growth (gain) and decline (loss). This belief is a fairly recent one and its theoretical foundation is not yet fully explored and tested.

The gain/loss argument. The gain/loss view of development emerged primarily for two reasons. The first relates to the task of defining the process of aging in a framework of development. The second reason deals with the fact of multidirectionality described earlier and the ensuing implication of simultaneous, multidirectional change for the characterization of development.

Concerning the issue of the definition of aging versus development: Traditionally in gerontology, there has been a strong push—especially by biologists (Kirkwood, 1985)—to define the essence of aging as decline (i.e., as a unidirectional process of loss in adaptive capacity). Behavioral scientists, because of their findings and expectations of some gains in old age, have had a tendency to reject this unidirectional, decline view of aging. Thus, they wanted to explore whether aging could be considered as part of a framework of development.

How could this integration of aging into the framework of development be achieved in light of the fact that the traditional definition of development was closely linked to growth, whereas that of aging was linked predominantly to decline? The suggestion of life-span researchers was to redefine or expand the concept of development beyond the biological conception of growth or progression. Specifically, the proposal was to expand the concept of development to include not only phenomena of growth (gain), but other directions of change as well (Baltes, 1983). As a result, development was defined as *any* change in the adaptive capacity of an organism, whether positive or negative. In developmental psychology, this proposal was consistent with other trends. Social learning theory, for example, had suggested a similar expansion of the directional nature of ontogenesis (Bandura, 1982).

The second and related reason for the emergence of the theme of gain–loss relations in development is a further elaboration of the notions of multidimensionality and multidirectionality of life-span intelligence. The separate concern for multiple-ability systems associated with multidirectionality was taken one step further to the examination of the relation and perhaps even the dynamic interplay *between* the various subsystems. The question guiding this investigation is whether the occurrence of multidirectional change, concurrently in separate components of the system (e.g., fluid vs. crystallized intelligence), requires a new conception of development itself. One possible avenue is to view development as a gain–loss relation (see also Baltes & Kliegl, 1986; Labouvie-Vief, 1980, 1982; Perlmutter, in press). According to this view, development at all points of the life course is a joint expression of features of growth (gain) and decline (loss). It is assumed that any developmental progression displays at the same time new adaptive capacity as well as the loss of previously existing capacity. No developmental change during the life course is pure gain.

The view of development as a gain/loss phenomenon, of course, does not imply that throughout life gain and loss exist in equal strength. Systematic age-related changes in the gain/loss proportion are likely to be present. A possible life-span scenario of the dynamic between gains and losses is illustrated in Figure 2. Summarizing evidence across a wide spectrum of functions, the proposition contained in Figure 2 is that the sum total of possible gains and losses in adaptive capacity shifts proportionally with increasing age. As a whole, life-span development proceeds within the constraints created by this dynamic.

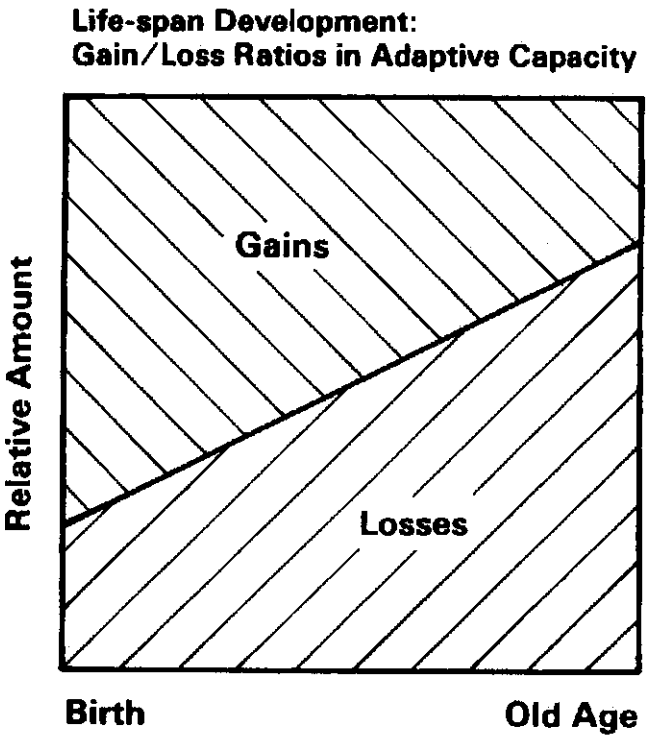

Figure 2. One theoretical expectation concerning the average course of gain/loss ratios is a proportional shift across the life span.

The concern with an ongoing, developmental dynamic of positive (gains) and negative (losses) change has spurred new research in life-span work. One example is the attempt to specify a general process of adaptation that would represent the lifelong nature of development as a gain/loss relation. Some of this work (M. Baltes, 1987; Baltes et al., 1984; Dixon & Baltes, 1986) has outlined a theoretical framework that is aimed at making explicit the dynamic relation between gain and loss in development. In Table 2, what is described for the case of cognitive aging is perhaps a prototypical change mechanism of "successful aging"—*selective optimization with compensation.*

The process of selective optimization with compensation has three features, each indicative of a gain/loss relation: (a) continual evolution of specialized forms of adaptation as a general feature of life-span development; (b) adaptation to the conditions of biological and social aging with its increasing limitation of plasticity; and (c) individual selective and compensatory efforts dealing with evolving deficits for the purpose of life mastery and effective aging.

Although the process of selective optimization and associated investments in terms of time, space, and behavior budgeting is assumed to be general and prototypical, its specific manifesta-

Table 2
Selective Optimization With Compensation: A Process Prototypical of Adaptive Life-Span Development of Cognitive Functioning

- A general feature of life-span development is an age-related increase in specialization (selection) of motivational and cognitive resources and skills.
- There are two main features of the aging of cognitive functions:
  (a) The reserve capacity for peak or maximum performances in fluid functioning (mechanics of intelligence) is reduced.
  (b) Some procedural and declarative knowledge systems (pragmatics of intelligence) can continue to evolve and function at peak levels.
- When, and if, limits (thresholds) of capacity are exceeded during the course of aging for a given individual, the following developmental consequences result:
  (a) Increased selection (channeling) and further reduction of the number of high-efficacy domains;
  (b) Development of compensatory and/or substitute mechanisms.

Note. This model is adapted from Baltes and Baltes (1980).

tion will vary depending on the individual life history. The emergence of compensatory and substitutive cognitive skills will also vary. For example, B. F. Skinner (1983) described in a personal account how and under which conditions he evolved compensatory or substitutive skills in the face of reduced effectiveness in select aspects of intellectual functioning.

Research by Salthouse (1984) on typing skills in old age is one persuasive example of how specialization and compensation interact in older adults to produce a high level of selective efficacy. Older expert typists—although showing less efficient reaction times than young expert typists when confronted with the typing of individual characters—nevertheless display good efficacy. They cope with their loss in reaction time when typing individual letters by developing more extensive forward-processing of letter and word sequences. As a result, older typists use a different combination of component skills than younger typists to produce a comparable level of overall performance.

Relevance of the gain/loss argument for other developmental questions. For historians interested in the study of social change and the idea of progress (Nisbet, 1980), the gain/loss argument is a truism. Few theorists would maintain that all of social change is progress.

What about ontogenesis? The notion that any ontogenetic change entails a dynamic interplay between gain and loss can be found also in biological conceptions such as Waddington's (1975) work on ontogenesis as differentiation and specialization (canalization). Beginning on the cellular level (Cotman, 1985; Lerner, 1984), differentiation clearly implies the loss of alternate courses of cell differentiation. Sociologists, too, have argued that the life course entails a process of specialization in the sense of commitment to and practice in selected domains of life (Featherman, 1983). Such a process of life-course specialization is assumed to imply a loss of alternative options.

Does the consideration of gains and losses as intrinsic to any developmental process have relevance for cognitive development in younger age groups? The fact that progress is not the only feature of age-related cognitive development has been known for quite some time. Weir's (1964) research with children on the developmental progression from maximization to optimization strategies in solving nonperfect probability tasks is a concrete example. This work shows that higher-level cognitive functioning (associated with the so-called optimization strategy) can have its costs when the task in question has no perfect solution. Specifically, when a cognitive task is logically unsolvable, because it has no perfect solution, young children can outperform older children and adults. This is so because older children and adults assume the existence of a logically perfect solution and, therefore, engage in a problem-solving behavior that is criterion-inadequate.

One additional example is Ross's (1981) research on the development of judgmental heuristics. Developmentally later or more "mature" heuristics can be less efficient, depending on the problem to be solved. Another case is second-language learning. Although there is disagreement about the sources of this gain/loss phenomenon, the fact seems accepted: The more and more efficient acquisition of a first language is associated with increasing difficulty in learning a second language (Davies, Criper, & Howatt, 1984; Kellerman & Smith, 1986).

The gain/loss idea is also contained in the work of Piaget, even though Piagetian theory is likely seen by most as the hallmark of a conception of development that features unidirectional growth. In the study of the age-development of visual illusions, for example, Piaget (1969) described illusions that increase with age and others that decrease with age. When visual illusions increase with age, Piaget ascribed this loss in visual accuracy to advancement in cognitive stage. A related example in Piaget's work (see Chapman, in press) is what he called the "repression" effect associated with a dynamic between perceptual and cognitive operations. With children of 7 to 8 years of age, Piaget found that their "veridical" perceptual knowledge was repressed by the (in this case, nonveridical) advancement in conceptual schemata. In effect, cognition "repressed" perception. A by-product of cognitive advancement, then, was a loss in veridical judgment involving perception.

It seems worthwhile to explore with greater force the idea that any process of cognitive development entails positive and negative aspects of change in adaptive capacity. In the long run, the treatment of this question is likely to be tied to the topic of adaptive fitness. In other words, as is true for evolutionary theories (as exemplified in the work of Gould and Lewontin [Lerner, 1984]), ontogenesis may not fundamentally be a process of general gain in the sense of a total increase in adaptive efficacy. As specific forms of mind and behavior are "selected" during ontogenesis for activation and growth, some adaptive capacities may actually become reduced. Whether the reduction is manifest would depend (as is true for evolutionary change) on the criterion demands posed by the individual and the environment in subsequent phases of life, or by the experimenter for that matter.

Plasticity of Development

Another belief (Table 1) held by many life-span scholars is that there is much plasticity in the course of life-span development. Plasticity refers to within-person variability and designates the potential that individuals have for different forms of behavior or development (Gollin, 1981; Lerner, 1984). Would the same individual develop differently if conditions were

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different? The question of plasticity is, of course, one that has excited developmental psychologists for a long time (e.g., McGraw's [1985] work in the 1930s on motor development in identical twins). It is of equal interest to current work in developmental biology (e.g., Cotman, 1985) and developmental sociology (Dannefer & Perlmutter, 1986; Featherman & Lerner, 1985).

Cognitive training research with the elderly. Whether it proves to be true, the conclusion that the plasticity of cognitive age differences found in the second half of life is larger than what is known from childhood research has impressed life-span researchers. The salience of the topic of plasticity for researchers in life-span development and the general approach used to study it can be illustrated easily in work on intellectual development during adulthood and old age. Initially, in life-span research the idea of plasticity was promulgated in connection with the question of whether intellectual aging is a simple process of gradual decline (Baltes & Schaie, 1976; Horn & Donaldson, 1976). One of the attractive ways to explore this question was to conduct intervention research.

Since the early 1970s, various research programs have been underway to examine the extent to which the observed aging losses in that cluster of psychometric intelligence evincing most definite decline—fluid intelligence—could be simulated for by performance variation (plasticity) within individuals. For example, elderly people were given practice in solving the type of intelligence problems used to measure fluid intelligence (Baltes & Kliegl, 1986; Willis, 1985). The key research hypothesis was that older persons, on the average, have relatively little test experience and everyday practice in fluid intelligence, but that they possess the reserve—the latent competence—to raise their level of performance on fluid intelligence tasks to that of younger adults.

The cognitive training research conducted with older adults offered strong evidence of sizeable plasticity. After a fairly brief program of cognitive practice, many older adults (age range, 60–80 years) exhibited levels of performance comparable with those observed in many "untreated" younger adults. Such findings have been replicated consistently and in other domains of cognitive functioning (e.g., Denney, 1984; Labouvie-Vief, 1985; Willis, 1985). Meanwhile, the evidence has been extended from cross-sectional to longitudinal age comparisons (Schaie & Willis, 1986).

These studies illustrate the emergence of the strong belief of life-span researchers in sizeable plasticity. Knowledge about plasticity of intelligence was judged to be as important as knowledge about the average course of age development. In order to achieve a comprehensive understanding of a given developmental process, such as intellectual development, one must forcefully advance the study of conditions that produce differences in development and highlight the potential for alternate courses of development. The resulting interpretative posture is that whatever one observes concerning the aging of intelligence is but one of many possible outcomes (Brandtstädter, 1984; Lerner, 1984). Knowing the range and limits of intraindividual functioning, therefore, is a cornerstone of the life-span perspective.

From plasticity to limits of plasticity. Current work on plasticity of life-span intellectual development has added new perspectives beyond those associated with cognitive training research. The focus has changed from demonstration of plasticity toward using research on plasticity as a strategy by which limits and boundaries of development can be identified (Kliegl & Baltes, 1987). This strategy is similar to child research on the "zone" of proximal development in childhood (Brown, 1982; Ferrara, Brown, & Campione, 1986).

The resulting focus in the life-span study of plasticity is not on the normal range of intellectual functioning, but on limits of performance. The research strategy chosen to examine different aspects of plasticity and its boundary conditions is known as *testing-the-limits* (M. Baltes & Kindermann, 1985; Guthke, 1982; Wiedl, 1984). Testing-the-limits involves the systematic application of (a) variations in modes of assessment, (b) methods of intervention aimed at identifying latent reserve capacity, and (c) strategies of identification of the mechanisms involved in growth and decline.

In our research efforts (Baltes et al., 1984; Kliegl & Baltes, 1987) intended to determine age-correlated changes in limits of intellectual functioning, three aspects of plasticity are distinguished: (a) baseline performance, (b) baseline reserve capacity, and (c) developmental reserve capacity. *Baseline performance* indicates a person's initial level of performance on a given task, that is, what a person can do in a specified task without intervention or special treatment. *Baseline reserve capacity* denotes the upper range of an individual's performance potential, when, at a given point in time, all available resources are called on to optimize an individual's performance. It is measured by tests of "maximum" performance. When conditions have been added that strengthen an individual's baseline reserve capacity through intervention (or development), we speak of an individual's *developmental reserve capacity.*

Distinguishing between these three aspects of plasticity permits the study not only of plasticity but also of constraints (Keil, 1981) and of what behavior geneticists have called the *norm of reaction* (see Lerner, 1984). Concepts such as constraint and norm of reaction are intended to index those limits—biological and sociocultural—that restrict the formation of a given behavior and its open development. In the long run, assessment of maximum reserve capacity aspires to identify biological boundaries of the plasticity of development. Note, however, that the range and level of maximum reserve capacity is inherently unknowable (see also Keating & MacLean, in press); it can only be approximated. The possibility always exists that new conditions or agents may be found that produce new levels and forms of intellectual performance on a given task.

The general expectation of testing-the-limits research is to predict developmental differences to be most pronounced, perhaps even approaching the condition of irreversibility (Wohlwill, 1973), near maximum levels of performance. Conversely, age changes are easily masked or modified as long as they are studied within the "normal" range of functioning. Figure 3 illustrates how a testing-the-limits strategy is used to obtain information about the range and limits of plasticity during adulthood.

The data presented in Figure 3 are based on subjects of different adult age groups who participated in extensive longitudinal intervention studies. In these studies, high levels of cognitive functioning in the use of a mnemonic skill are engineered in the laboratory. Specifically, subjects participated in 30 sessions of training of expert memory for digits and nouns using the Method

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