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TOWARD PSYCHOLOGICAL THEORIES OF AGING AND DEVELOPMENT

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INTRODUCTION

Efforts at theory construction occur in a context of scientific and cultural history (Coan, 1968, 1970; Kuhn, 1970; Merton, 1975; Riegel, 1972, 1973a, b) and are embedded in metatheoretical postures and arguments (Marx and Hillix, 1973; Reese and Overton, 1970; Wolman, 1973). From a pessimistic stance, therefore, an exposition on psychological theories of aging may be regarded as a Sisyphean task. First, theories are never complete or ultimate, nor has the field of psychological aging yet reached a stage of scientific development where theoretical positions are sufficiently accentuated to warrant more than the label of prototheories. Second, the *Zeitgeist* in psychology is not one of comprehensive, unitary, monistic theory building but one of pluralism dealing with the formulation of diverse and domain-specific miniature theories. To paraphrase Berger and Lambert (1968, p. 82), psychological theories do not stand serene, complete, and unchallenged at some high level of abstraction. They are part of a dynamic and pluralistic exchange between scientists and their efforts to represent a complex and continuously changing phenomenon.

It is our belief that the present state of theoretical pluralism and of metatheoretical and metamethodological concern reflected by psychology as a whole is not the mirror of a sad state of affairs or a dilemma, either for psychological theories in general or for psychological theories of aging and development. On the contrary, our position is that the present scientific forum is one which allows for novel formulations and allocations of scientific resources. The field of gerontological psychology can benefit from this context if we make explicit efforts to participate in the making of psychology. In this way, research on psychological aging can maximize its contribution both as a basic field of inquiry in its own right and as a forum for research within the conceptual framework of established theories in other areas of psychology (Birren, 1960).

The focus of this chapter, therefore, is on metatheory and a comparative analysis of major theoretical positions. This vantage point is similar to the ones taken earlier by Bromley (1970), Reese and Overton (1970), and Baltes (1973b). Specific theories or models of psychological aging and development will be mentioned only if these are relevant to the purpose of metatheo-

retical and comparative discourse. Readers interested in summaries of specific theoretical positions may want to consult various review chapters in the *Annual Review of Psychology* (Birren, 1960; Botwinick, 1970; Chown and Heron, 1965; Schaie and Gribbin, 1975), introductory texts (Birren, 1964a; Botwinick, 1973; Bromley, 1974; Kimmel, 1974; Lehr, 1972), edited review volumes (Baltes and Schaie, 1973a; Eisdorfer and Lawton, 1973; Goulet and Baltes, 1970; Talland, 1968), collections of readings (Chown, 1972; Neugarten, 1968a; Thomae and Lehr, 1968), and the remaining chapters in the present volume.

NATURE OF SCIENTIFIC THEORY

Objectives of Theory

Marx (1970) maintained that theory may be viewed as having two major complementary functions: It serves as a *tool* in the process of knowledge generation, and it is a *goal* of science with the implication that there is an ultimate, ideal level of knowledge represented in a theory. This distinction is useful from a didactic viewpoint. It breaks down, however, if one asserts that there is no final stage of knowledge and that knowledge is part of a dynamic, interactive system involving persons and events. With Marx and Hillix (1973, p. 3), the idea that science is not a personal but "many-sided social enterprise" is emphasized.

In the effort to organize a system of statements about objects and events, three interrelated key objectives of science are the center of attention: (a) *knowledge generation*, (b) *knowledge dissemination*, and (c) *knowledge utilization*.*

*Traditionally, the position taken on science development has been to assign primary weight to the generation and dissemination of knowledge as they flow from perspectives which are largely internal to a given theory. The intent of the present argument, asserting that knowledge utilization (in a general sense to include non-scientists) is a valid third component of theory building and evaluation, is not to downgrade the role of basic research or the traditional significance placed on a permissive context for the activity of basic researchers (see also Rozeboom, 1970, p. 74). On the contrary, we believe that an atmosphere for "basic" research is an important condition for stimulating advances in knowledge generation. The argument, however, is that aspects of knowledge utilization transcend the realm of

Conceptualizing science as an intrinsically social rather than purely academic enterprise is not generally accepted. The major implications of viewing science as a social enterprise are that the structure and function of science are not invariant but subject to complex changes with time. Furthermore, it is asserted that there is never a final set of prescriptions which defines what is scientific and what is not. As a corollary, our interpretation is that science is judged by criteria of usefulness, not only internal to the logic of the scientific method, but also external to the scientific method and related to the social context in which science occurs. In other words, our view is that science involves aspects of both knowledge generation *and* knowledge application.

The formulation and evaluation of theories are seen as being helpful or even critical to each of the three interrelated tasks involved in the making of science: knowledge generation, knowledge dissemination, and knowledge utilization. The criteria for what constitutes a theory and what represents an acceptable format of theory construction are part of the domain of the philosophy of science. Excellent reviews aimed at applying generic perspectives on theories and theory construction to the field of developmental psychology and aging are those by Bromley (1970), Langer (1969), and Reese and Overton (Overton and Reese, 1973; Reese and Overton, 1970). It is a widely held belief that there are several legitimate and useful types of theories and strategies of theory construction (see also Royce, 1970; Rozeboom, 1970).

Construction and Evaluation of Theory

Scientific theories form a deductive system. A "theory" is a set of statements including (a) general laws and principles that serve as axioms or assumptions, (b) other laws which are deduc-

activities known by a single researcher, and are valid ones in constructing and evaluating theories, and that it is desirable to consider the interactive relationships between the internal and contextual usefulness of theory formulation. A full-fledged discussion of the interactive relationship between science and societal development is contained in some recent European publications (e.g., Holzkamp, 1967, 1970), though unfortunately they are often clouded in political debate.

ible from the general axioms, and (c) coordinating definitions relating theoretical terms to observational sentences. Whenever the judgment is made that a theory is not sufficiently complete or fully consistent, one speaks of "*proto-theories*" (Baldwin, 1960). Most of the theories in psychology are typically judged to be of the prototheoretical kind. A theory does not only *form* a set of statements; it is also *part* of a larger system of statements, often, but not necessarily ordered in levels. This larger system is occasionally defined as a paradigm, world view, metatheory, or metamodel. In other words, there are not only levels within a theory but also levels of models and/or theories.

In the context of describing the evaluation of theories, Kaplan (1964, p. 313) stated: "Truth itself is plainly useless as a criterion for the acceptability of a theory . . . we must proceed conversely . . . and characterize truth as the outcome of inquiry, suitably carried out." Scientific theories differ in many ways and for good reasons (Marx and Hillix, 1973): A major one is the state of development and explicitness.

The evaluation of theories proceeds along three lines. First, the evaluative examination is concerned with the *internal logic* of a theory in terms of consistency and testability. In this regard, the evaluation seems to follow the truthfulness criteria suggested by logic. Second, the evaluation centers on the *relationship between theoretical statements and empirical evidence*. It is in this regard that theories cannot be proven to be true but only supported by empirical evidence. A third aspect of evaluation of theories involves the *relationship between the three functions of a theory: knowledge generation, knowledge dissemination, and knowledge utilization*. A joint focus on knowledge generation, dissemination, and utilization in evaluating theories derives its rationale from considering science a social enterprise as described above.

There is another set of attributes which is often used (e.g., Frank, 1961; Lachman, 1963) to describe the evaluative status of theories. The three major attributes are (1) *precision*, (2) *scope*, and (3) *deployability* of theories. The level of precision of a theory refers to the accuracy and unequivocacy of prediction and control. Precision includes both aspects of theory-datum agreement and such attributes as

simplicity or parsimony. The scope or generality of a theory refers to the spectrum of subject matter which a given theory is purported to cover. Kaplan (1964) speaks of the range of heterogeneity of facts. Deployability of theories is sometimes also called fertility (Frank, 1954 in Frank, 1961) and is particularly tied to the process of knowledge dissemination and knowledge utilization.

The evaluation of a theory, then, is guided both by truth criteria of internal validity associated with the assessment of precision and by aspects of external scientific and social validity (usefulness) involving scope and deployability. Evaluation of theories, therefore, is a complex task which is never complete. The multiple functions and criteria attached to theories and their evaluation are the main reasons why theories seldom die.

Models and Theories

Some philosophers of science and researchers in the field of development and aging find it important to separate models from theories (Kaplan, 1964; Lachman, 1963; Reese and Overton, 1970)—although this distinction is far from unequivocal, and the terms "model" and "theory" are often used interchangeably.

The suggestion is made that much of the confusion and arguments surrounding specific theories and proper strategies of theory construction and theory evaluation is due to the fact that theories and models are not seen as independent structures which, however, are functionally related. According to Lachman (1963), a model is structurally separate from a theory but is part of its axioms. Axioms, as discussed earlier, represent one of the three components of a given theory. "Any theory presupposes a more general model according to which the theoretical concepts are formulated" (Reese and Overton, 1970, p. 117). Furthermore, there are levels of models and theories. If one accepts a hierarchical system, for example, any theory is formulated within a metacontext of theory building and, at the same time, any model is conceptualized within a metacontext of model building.

In our view, the distinction between models and theories is indeed a useful one. Distinguish-

ing between models and theories helps clarify the difference between the *external context* in which theory construction and evaluation proceed and the *internal validation* of theories. In other words, separating the assumptive contextual network of a theory (its metatheory or model characteristics) from its intrinsic set of laws and concepts which are not assumptive but testable is desirable. In this vein, Reese and Overton (1970) use the term model to describe the paradigmatic context for theory building. General models such as "world views," "paradigms," or "world hypotheses" are metamodels which delineate the kind of theories which may be developed for a given subject matter by a given researcher with a given model orientation. Models, thus, circumscribe the axiomatic set of features which are a part of any complete theory at whatever level of development. Furthermore, since models are seen as representing the axiomatic metaproperties of a theory, they should not be evaluated on criteria of truth but on criteria of pragmatic usefulness.

Reese and Overton (1970; Overton and Reese, 1973; see also Looft, 1973a,b) apply the distinction between models and theories to the study of development and aging and illustrate its conceptual usefulness. For example, a recognition of the organismic model characteristics of Piagetian theory clarifies Piaget's (1970) position that his theory of cognitive development cannot be tested via behavioristic learning paradigms because these are part of a mechanistic world view. An application of the model-theory distinction also suggests that perennial dilemmas or issues in the study of development (e.g., holism vs. elementarism, structure-function vs. antecedent-consequent, discontinuity vs. continuity, phenotypic vs. genotypic, etc.) are largely a reflection of metamodel and not theory differences.

NATURE OF PSYCHOLOGY

Current Status of Psychological Theory

Psychology is a science and a profession (Clark and Miller, 1970; Graumann, 1972), and as a discipline it is, therefore, concerned with the formulation of knowledge of interest to the entire spectrum of psychological professionals.

How the behavior of organisms is studied and

organized varies along many dimensions. On the one hand, there are multiple rival strategies and levels of theory formulations and theory evaluation. Such rival approaches can lead to independent structures of psychological theories. On the other hand, psychologists differ in their emphases or preferences for distinct empirical methodologies and subject matters. In the absence of a unified theory and a monolithic definition of behavior, pluralism is in vogue in current psychology (Kendler, 1970; Marx and Hillix, 1973), which leads Gilgen (1970) to conclude that psychology is still in a pre-paradigmatic (Kuhn, 1970) period. These conclusions seem valid despite occasional and important efforts at unification and integration in method and theory (e.g., Royce, 1970). A general systems view (Bertalanffy, 1968; Buckley, 1968; Sadosky, 1972) appears to play a central role in the search for integrative formulations.

Accordingly, emphases in psychological method and theory are not seen as existing in fragmented or hierarchical units nor is reductionism (e.g., all psychological events will ultimately be accounted for on the level of biological analysis) the only acceptable strategy towards knowledge building. This change in perspective from a monolithic orientation towards a constructive-pluralistic posture is important for a discussion of psychological theories of aging. For example, the traditional focus on viewing biological mechanisms as "more basic" to the aging process than psychological or sociological mechanisms does not seem to hold up against current trends in metascience. Brunswik's (1955, p. 237) conclusion that "insistence on reductionism as a universal goal of science can only result in blighted spots on the landmap of scientific enterprise" appears to survive (see also Jessor, 1963; Kantor, 1973; Royce, 1970; Wolman, 1973). Conceptual and factual agreements, contradictions, and complementarities are all a legitimate part of the system of psychology.

Major Dimensions and Systems of Psychological Theories

Having a perspective on the scope of psychological theories is helpful in identifying and examining the status of any specific psychological

emphasis such as the psychology of aging. When it comes to a comprehensive account of the substance and scope of psychological theories, there are at least three strategies to be discerned.

First, there is an effort at developing a taxonomy of psychology on the basis of metatheoretical and metamethodological grounds (Reese and Overton, 1970; Royce, 1970; Wolman, 1973). Second, the empirical method is brought to bear on examining psychologists themselves (what do psychologists do?) as demonstrated by Coan (1968, 1970). Third, efforts are made to organize psychology around schools or systems of thought or theoretical positions. This approach is typically implemented in books on the history of psychology (e.g., Boring, 1950). Each of these complementary approaches is useful in illustrating the richness and diversity of psychology as a science and profession in relation to theories of aging.

As to a metatheoretical approach, Royce (1970) has been particularly active in promoting a taxonomic analysis of representative general theories in contemporary psychology. His primary focus is on assessing the present situation in theoretical psychology in terms of underlying epistemologies (empiricism, rationalism, metaphorism) and on an evaluation of formal and empirical properties (see also Kendler, 1970). Notwithstanding the numerous pitfalls in proposing such a taxonomic and evaluative framework, it is our belief that Royce's (1970) basic

approach and intent is a useful one and deserves attention before embarking on a long journey into the construction of psychological theories in the field of aging.

The second traditional way of organizing psychological theories is to delineate empirical emphases as they are reflected in the work and conceptions of psychologists. Such an empirically based approach to identifying basic patterns of theoretical orientations in psychology was taken by Coan (1968, 1970). Using ratings from psychologists, Coan analyzed 17 factors at a first-order factor level from which, on a second-order level, five second-order bipolar factors were deduced. These were further reduced on the third-order level to one single bi-polar dimension.

The entire outcome of Coan's (1968, 1970) research on the dimensions of psychological theory is depicted in Figure 1 which shows the multidimensional space of theoretical psychology on the second and third order of factor analysis. The general third-order dimension of *Fluid versus Restrictive Orientation* is described as follows: The psychologist, for example, whose theoretical orientation is fluid tends to be concerned with conscious experience, favors dealing with wholes in both theory and research, and is willing to employ relatively loose and informal methods. The psychologist with a restrictive orientation is more inclined to confine his attention to overt behavior, favors strict be-

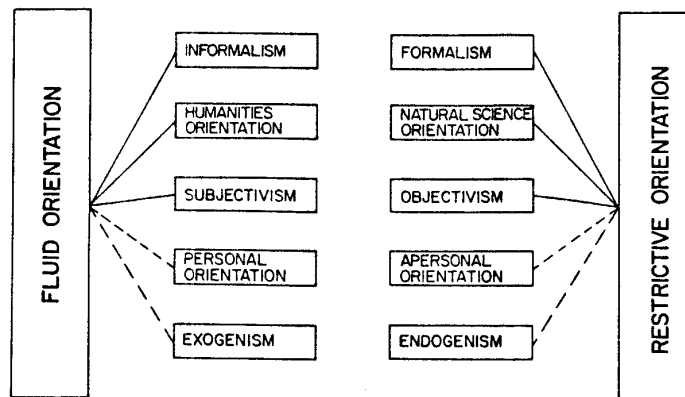


Figure 1. A bipolar hierarchy of theoretical-orientation factors in psychology at second and third-order level. On either side are terms representing two poles of five second-order and one third-order factor each. Seventeen first-order factors are not shown; dashed lines indicate relatively weaker factor connections. (After Coan, 1970.)

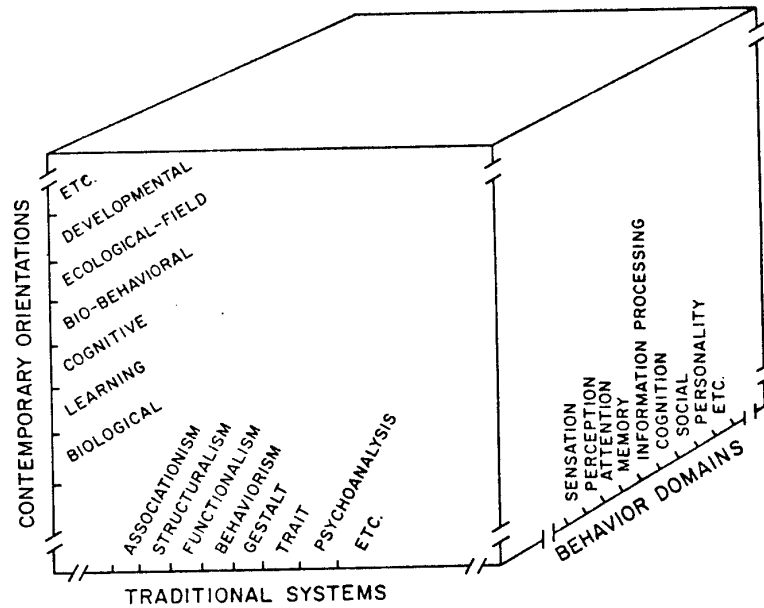


Figure 2. An illustration of pluralism in current psychological theory. (Most researchers may question whether traditional systems will lead to theories which are satisfactory in scope, precision and deployability.)

havioral terminology, prefers dealing with processes and structure abstracted from people, and favors contents and methods of the natural sciences.

A third strategy, aimed at developing a comparative framework for examining psychological theories of aging and development, is to organize a matrix containing a classification of psychological theories or orientations as reviewers see them in their assessment of contemporary research (e.g., Boring, 1950; Lowry, 1971; Marx and Hillix, 1973). Summarizing our impression both from Marx and Hillix's (1973) review of systems in psychology and the organization of various handbooks in developmental psychology (e.g., Goslin, 1969; Mussen, 1970), Figure 2 is offered as a heuristic device. It is presented in full recognition of shortcomings dealing with the number of categories given and uncertainty about internal relationships of the structural elements included.

Figure 2 is organized in terms of three categories: (1) *traditional systems* in psychology as largely described by Marx and Hillix (1973), (2) *domains of behavior processes*, and (3) major *contemporary theoretical orientations* as often

found in the current psychological literature. Theoretical orientations are conceived of as having the potential to lead to major new systems of psychology in the near future if proven to sustain usefulness. The intent of Figure 2, then, is to illustrate within which sets of theoretical systems, behavior processes, and theoretical orientations a large share of current psychological research is being conducted and theories are being built. It is not asserted that all cells of the three-dimensional cube can be found in the literature; however, it is maintained that most of the combinations are available, at least in approximation, when examining both present and past psychological research. The three-dimensional scheme could be easily extended or modified, for example, by adding or using a *model of man* dimension (e.g., active vs. reactive) as described by Reese and Overton (1970; Overton and Reese, 1973), or a dimension containing *methodological modes of datum definition* (e.g., behavior vs. neurophysiological events vs. phenomenal experience) as suggested by Kendler (1970).

In our view, Figures 1 and 2 illustrate on a concrete level the state of current psychological

theory. As indicated before, psychology in the 1970's is in a state of paradigmatic pluralism, and we are dealing at best either with miniature theories or theories of the orientational or prototheoretical kind. The next step is to apply the preceding sections on metatheory and psychological theory to the field of aging and development.

PSYCHOLOGICAL THEORIES OF AGING AND DEVELOPMENT

Within the matrix of *traditional systems, developing theoretical orientations* and *behavioral domains* (Figure 2) described, the central task now is to determine the core elements for psychological theories of aging.

A first immediate conclusion deriving from the foregoing focus on metatheory and pluralism is that the way psychological aging is actually studied depends in large part on considerations which are external to aging as a subject matter. In fact, it is a major contention of this chapter that, especially in a young field such as aging, recognizing the import of the metatheoretical biases which regulate the scientific behavior of the pioneers and leaders making the field is of paramount importance. The importance of contextual variables is stressed because we see science as a many-sided social enterprise and believe that research and theory are selectively dependent not only upon a metatheoretical framework but also upon the "social, economic and political conditions of the society in which we happen to live" (Riegel, 1973b, p. 56; see also Keniston, 1971).

Historical Perspectives

In analogy to Zigler's (1963) and Bronfenbrenner's (1963) excellent analyses of the field of child development a decade ago, most recent reviews of the field of psychological aging (e.g., Bühler, Keith-Spiegel, and Thomas, 1973; Looft, 1972, 1973a; Riegel, 1973b; Schaie and Gribbin, 1975) suggest that theory in the field of aging is in a period of conceptual transition. Although the reader is referred for a detailed account to Chapter 4 of this volume on history by Riegel, a few selected observations on theoretical emphases and trends are given.

On the one hand, there is an obvious quantitative explosion in geropsychological research

as demonstrated by various analyses including the ones by Charles (1970), Groffmann (1970), Looft (1972), and Riegel (1973b) which was accurately projected by earlier reviewers (Birren, 1960; Munnichs, 1966a). In addition to this quantitative explosion, there is a continued movement toward better articulation of theory and a shift from descriptive to explanatory process analysis aptly described by Bronfenbrenner (1963), Looft (1972), and Wohlwill (1973). In this regard, the psychology of aging benefited greatly from the fact that some of its pioneers were theoretically sophisticated and committed to experimental-explanatory research.

On the other hand, when examining the pluralistic matrix of psychological approaches described in Figures 1 and 2 in historical perspective, one might wonder whether Anglo-American research on psychological aging has suffered (or at least advanced unevenly) due to its close ties to strong leaders who favored experimental-behavioristic, psychometric, and bio-behavioral metamodel conceptions. Comparatively speaking, there has been a research thrust on biological-decremental views, on basic processes of the sensation-perception-information processing kind, and on the use of structuralistic and mechanistic rather than organismic and functionalistic modes of studying behavior. The study of cognitive, affective, emotional, and social behavior phenomena has, comparatively, lagged behind—as has the consideration of theoretical orientations associated with developmental learning, socialization, ecological-field, and ethological perspectives, notable exceptions notwithstanding (e.g., Bengtson and Black, 1973; Bortner, 1967; Brim and Wheeler, 1966; Goulet, 1970; Kastenbaum, 1967; Lawton and Nahemow, 1973; Lowenthal and Chiriboga, 1973; Neugarten and Datan, 1973; Schaie, 1962; Thomae, 1970).

Whatever the specific interpretation of historical trends, it seems important to project past, current, and future psychological research on aging into a pluralistic framework of psychological theory. Continuous monitoring and reflection is helpful in identifying relative strengths and weaknesses and in making the psychology of aging not only an open recipient of, but also an active and interactive contributor to, the general field of psychology as suggested in one of the early reviews of the field (Birren, 1960).

A good collection of examples for recent advances into existing theoretical niches are the increased use of cumulative and hierarchical developmental learning models (e.g., Goulet, 1970, 1973; Hoyer, 1973; Hultsch, 1974; Labouvie-Vief, Hoyer, Baltes, and Baltes, 1974); the systematic introduction of ecological and ethological perspectives (Lawton and Nahemow, 1973; Willems, 1973); the programmatic resurrection of a life-span developmental approach to the study of aging (Baltes, 1973a, Baltes and Schaie, 1973a; Goulet and Baltes, 1970; Nesselrode and Reese, 1973); the focus on a developmental approach to the study of behavior genetics (Jarvik, 1975); and the beginnings of a dynamic, dialectic view of the study of behavior-environment systems (e.g., Riegel, 1973c, 1976 in press) with its goal to capture both ontogenetic and evolutionary change components. It has been argued that research on psychological aging in some of these areas has led to novel conceptualizations which are having some impact in other domains of psychology as well.

Toward Description of Psychological Aging and Development

If one translates the definition and objective of psychology into concrete goals, psychological theory on aging should lead to a body of knowledge which facilitates the interrelated objectives of (1) description, (2) explanation, and (3) modification or optimization of aging behavior (Baltes, 1973b) at a specified level of precision, scope, and deployability.

In any discussion of aging behavior, one is initially faced with the perplexing tasks of (1) defining the target class of behaviors and (2) delineating appropriate descriptive methodologies. The boundaries limiting the area of psychological aging are indeed vague and often subject to dispute (e.g., Birren, 1964b). Birren's (1959b, p. 5) conclusion that "aging as a concept will not be defined at once and for all but will over time be redefined" is an apt characterization of a pluralistic and evolutionary view.

When evaluating the current status of the descriptive analysis of aging behavior, there are three sets of issues. The first deals with the delineation of the concept of aging itself. The sec-

ond issue involves the question of adequate methodology for the study of aging behavior both with regard to the need for change analysis and for representative and fair measurement. The third issue deals with the question of which variables need observation in order to provide for a body of data suitable for explanatory analysis.

Aging as a Multidirectional Change Process. The term "aging" carries multiple meanings and, in some ways, it may be ill chosen. The major theoretical advantage which we see in the term aging (in contrast for example to gerontological psychology) is related to its implicit focus on *process* and *change* (e.g., Thomae, 1959). This is contrasted with a posture where age would only enter as a quantitative parameter into a theory of behavior of the general psychology type.

There are two major theoretical disadvantages, however, stemming from an unreflective, prescientific use of the term aging. One involves the potential to equate aging with deterioration and decrement. The second disadvantage which the term aging often produces is to suggest that the major explanatory task of aging research is to use "age" as the primary explanatory determinant for aging behavior.

Our bias is to capitalize on the primary advantage of the term aging and to conclude that the focus is on a behavioral process. In order to prevent identifying psychological aging primarily with decrement phenomena (e.g., Botwinick, 1973; Busse, 1969), it is our definite preference to combine the terms aging and development (see also Birren, 1964b) on a conceptual level or to speak simply of behavioral change in aging.

It remains to be discussed which form a behavioral process should take to be classified as aging. It is our judgment (Baltes, 1973b; Baltes and Schaie, 1973b; Baltes and Willis, in press; see also Birren, 1959b; Hoyer, 1974; Thomae, 1959) that the nature of behavioral change at all stages of the life span can take many forms in terms of directionality, range, or intensity, depending upon the class of behavior and theoretical orientation chosen. Therefore, it is desirable to refrain from the application of strict generic criteria such as unidirectionality, irreversibility, and universality when delineating aging change although these attributes may ap-

ply to *some* behavioral changes at *some* historical periods for *some* organisms. (The point here is not, for example, that sequential-directional-irreversible behavioral changes of the organismic kind [Reese and Overton, 1970] are not useful, but that these represent only a segment of the metamodels of behavioral development which can be construed.)

Descriptive Components of Behavior-Change Processes and Aging. The recognition that the form of behavioral change in aging can be multidirectional, however, does not solve the general question of which behavioral changes are to be identified with aging; it only helps prevent a stereotypic and inadequate approach to the phenomenon of psychological aging. The search for a definite set of criteria is similar to the one faced with the concept of developmental change (Baltes, Reese, and Nesselroade, 1976 in press; Birren, 1964b; Harris, 1957; Thoma, 1959; Tobach, Aronson, and Shaw, 1971).

On a descriptive level, there are a number of criteria which delineate the class of behaviors to be labeled as aging or developmental. First, the focus is on *time-trajectories of change* or on "a determinate chain of events occupying a significant portion of the life span after maturity" (Birren, 1959b, p. 5). These chains of events are assumed to express regularity. Second, we need to recognize that, for a behavioral process to be useful for aging-related theory building, it needs to exhibit some formal property of *parsimony*, *normalization*, or *generality* either on the level of nomothetic or idiographic analysis. Third, aging behavior is restricted primarily to those behavior change processes which characterize the *second part of the life span*; however, it may be useful to link late-life changes to antecedent changes in the first part of the life span in order to obtain a complete account of behavior-change functions.

Figure 3 summarizes this definitional position on aging behavior in schematic form. Behavior-change processes are seen as the crucial target phenomenon (see also Baer, 1970; Harris, 1971); traditional age-change functions (Wohlwill, 1973) are a special case of a general class of behavior-change functions. In addition, it is argued that psychologists typically conceptualize behavior-change processes on the level of indi-

vidual analysis. Accordingly, change on the individual level involves *intraindividual change*, and differences in change functions between individuals, i.e., *interindividual differences in change* (Baltes, 1973b; Baltes, Reese, and Nesselroade, 1976 in press; Buss, 1974a; Rudinger, 1976 in press). It is suggested further in Figure 3 that one of the important features of aging is that interindividual differences typically increase with time and age resulting in progressively less age-related homogeneity (e.g., Bortner, 1967; Britton and Britton, 1972; Busse, 1969; Fozard and Thomas, 1975).

Furthermore, it is shown in Figure 3 that behavior-change can be multidirectional (incremental, decremental, curvilinear, etc.). The form and directionality of change patterns can also be conceptualized in many ways including the distinction of quantitative (more or less of a given attribute) versus structural (different sets of attributes or differing interrelations among attributes) change (e.g., Baltes and Nesselroade, 1973; Buss, 1974a; Catania, 1973; Van den Daele, 1974). Whether change is conceptualized in terms of quantitative and/or structural-qualitative components is to a large degree a function of the metamodel of development employed.

Figure 3 suggests also (see next section on explanation) that order and regularity in behavior change is produced or programmed by two interacting influence patterns: ontogenetic and biocultural systems. An underlying assumption is that a process orientation towards a psychology of aging is not desirable on *a priori* grounds but is only useful if the empirical behavior-change functions exhibit sufficient order and regularity to warrant systematic theoretic and empirical analysis (see also Baltes, Reese, and Nesselroade, 1976 in press; Fahrenberg, 1968; Wohlwill, 1970a,b; 1973).

At this time we cannot emphasize enough the statement that the construction of chronological age functions is only one way to implement time-trajectories and behavior-change approaches. Chronological age is a useful organizing parameter only if intraindividual change patterns (in form and level) are sufficiently homogeneous to yield a high correlation between chronological age and behavior change. There is nothing sacred about chronological age being a

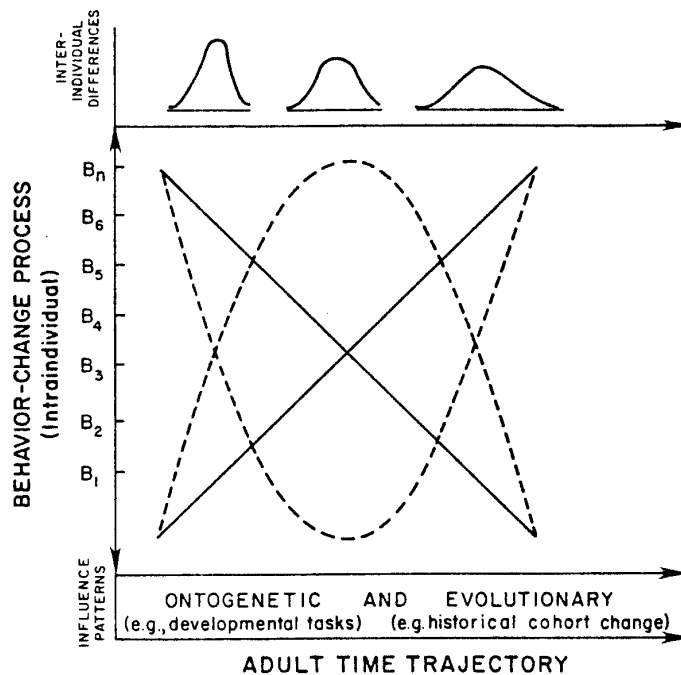


Figure 3. Selective examples of multidirectional but systematic behavior-change processes: Ontogenetic and bio-cultural influences interact in the production of normative change patterns (age functions are a special case of behavior-change processes).

sine qua non key variable as long as regularities in behavior-change functions can be detected. For example, if interindividual differences regarding age-behavior change functions (onset, schedule, etc.) are large, it is not useful to focus on chronological age-change models as representations of intraindividual change patterns. On the contrary, such behavior-change functions can be better examined outside a chronological age framework. A given class of behavior-change processes might occur at different age levels and periods for different organisms depending upon the unique schedule of life histories and the timing of critical life events.

Such an age-irrelevant but sequence-relevant approach to the study of development and aging has been argued most persuasively by operant developmentalists such as Baer (1970) but also by organicists such as Werner (1948). A persuasive example is that of the terminal drop phenomenon (Blum, Jarvik, and Clark, 1970; Jarvik, 1975; Riegel and Riegel, 1972) which suggests a determinate chain of behavior

changes which, however, is less related to chronological age *per se* than to the time of death and, therefore, its onset varies widely among persons. Another example is the use of social learning theory (Ahammer, 1973) for the study of adult and gerontological personality. Furthermore, the strong focus placed by the Chicago group (e.g., Neugarten, 1968a) on contextual factors (social class, cultural settings) and interindividual differences makes a concern with intraindividual process rather than with simple and universal age change during adulthood and aging of paramount significance.

Description of Aging: Evaluation of Present Knowledge

A general assessment of the present descriptive knowledge about aging behavior leads us to conclude that the full spectrum of models of behavior change has not been explored. Considering both the pluralistic situation described in Figures 1 and 2 and the multidirectional and

process-oriented perspective depicted in Figure 3, the following general observations are made.

First, from a methodological perspective (Baltes, 1968; Baltes, Reese, and Nesselrode, 1976 in press; Rudinger, 1976 in press; Schaie, 1965, Chapter 2, in this volume) it is important for gerontologists to fully recognize that research has to concentrate on strategies which indeed allow for the direct assessment of change and change processes rather than time-specific interindividual differences.

Second, with a view of theoretical orientations, the majority of descriptive data about aging have been collected within a meta-framework of biological behaviorism and/or a strong orientation towards a personological, bio-behavioral perspective rather than a contextual developmental-field view. Furthermore, the expectation has been that aging behavior is pervasively regressive or decremental. Kastenbaum (1965, 1967, 1973; see also Baltes and Labouvie, 1973) has been particularly persuasive on this point and has suggested that the prevalent meta-approaches to the study of psychological aging may have led to a body of descriptive knowledge which is unrepresentative of the universe of adult and gerontological behavioral changes.

The conclusion, then, that aging change is change toward slowness, less behavior, less acquisition, less performance, and greater dependency (e.g., Birren, 1959a, 1964a; Botwinick, 1973) may be a function of the theoretical orientations applied rather than a representative assessment of the universe of aging change itself. Data focusing on the questionable negative impact of retirement on life satisfaction (Carp, 1966), the dramatic increases in interindividual differences in behavior with age (Bloom, 1964; Britton and Britton, 1972; Busse, 1969; Fozard and Thomas, 1975), the strong impact of biocultural, historical change on the nature of adult behavior (Nesselrode and Baltes, 1974; Schaie, 1970), and the feasibility of a bi-directional model of intellectual development involving the fluid versus crystallized dimension (Horn, 1970) are all examples of an increasing body of descriptive knowledge challenging a generic decremental view of behavioral aging.

As to the need for well articulated behavior-change models, there is a dearth of them partic-

ularly if one steps outside the realm of simple quantitative age functions. Nevertheless, there is growing recognition of the need for behavior-change models however prototheoretical they may be. The formulation of psychological age concepts (Birren, 1959b; see also Kastenbaum, Derbin, Sabatini, and Artt, 1972; Nuttall, 1972), developmental-tasks models (Havighurst, 1948), and age-grade systems (Neugarten, 1968b; Neugarten, Moore, and Lowe, 1965) are commendable. Similarly, potentially useful and parsimonious behavior-change stage models have been proposed by Erikson (1959) and Bühler (1933; Bühler and Massarik, 1968) in the area of personality (see Havighurst, 1973; Looft, 1973a, for overviews) though primarily with a personological and structuralistic orientation. Furthermore, in the area of learning and cognition, Gagne (1968), Goulet (1970), and Buss (1973b) have formulated hierarchical and cumulative models which permit the systematic examination of behavior change patterns involving both structural and quantitative change attributes. Clearly, the stage is set for a concerted effort toward formulating process-oriented change functions.

There is one final comment on the adequacy of the descriptive data base in psychological research on aging. In line with Sigel's (1974) commentary on the adult-centric approach of child developmentalists and Neugarten's (1968b, 1969) concern with discontinuities between child- and adult-developmental issues, it seems fair to conclude that descriptive psychogerontological research can be characterized as being equally youth- and adult-centric, since relatively little effort has been made to construct measurement instruments with a primary view on aging. Therefore, there appears to be a host of gaps in current descriptive taxonomies of adult and gerontological behaviors. The emerging search for what is unique and representative of aging behavior is reflected, for example, in recent emphases on studying such behavioral phenomena as wisdom (Clayton, 1975), time perspectives (Bortner and Hultsch, 1974; Munichs, 1966b; Marshall, 1974), life-review processes (Butler, 1963; Falk, 1970), personal control, mid-life crises (Brim, 1974a,b), and adult coping with professional, inter-, and intrapersonal stress (Coelho, Hamburg, and Adams,

1974; Dohrenwend and Dohrenwend, 1974; Lowenthal and Chiriboga, 1973). This selected set of examples illustrates the growing interest in a richer universe of adult-developmental behaviors.

The primary conclusions from this brief sketch of various approaches to the descriptive analysis of adult and aging behavior are twofold. On the one hand, a greater variety of metamodels of behavior for conceptualizing adulthood and aging is desirable as is concern with change methodology. On the other hand, it is the focus on behavior-change models rather than on simple age functions which is judged to be most facilitative of vigorous theory building. Furthermore, it is asserted that a descriptive taxonomy of behavior-change patterns (including multidirectional age functions as well as incremental, decremental, curvilinear, cyclical and hierarchical ones which are less related to chronological age than to "age-irrelevant" developmental sequences) will be the first step towards achieving a differentiated view of aging processes. A pluralistic but precise specification of behavior-change models is indeed seen as most crucial in moving the concept of aging from a prescientific to a prototheoretical level.

Toward Explanation of Psychological Aging and Development

The major task of explanation (Baltes, 1973b; Birren, 1959b; Reese and Overton, 1970) is the search for predictive determinants of psychological aging and development ideally involving determinants of the causal type. While in description the primary focus is on behavioral observation, the emphasis in explanatory and analytic analysis is "on the evaluation of the explanatory value of variable relationships in accounting for intraindividual change and inter-individual differences in such change sequences" (Baltes, 1973b, p. 461).

Metatheory and Explanation. The preceding sections suggest at least three preliminary observations on this topic.

First, philosophers of science suggest that there is no monolithic strategy for the search of determinacy and causality nor any single causative agent for a given outcome; causality has constructive and representational features and the evaluation of predictive or explanatory

statements is guided by criteria of precision, scope, and deployability. Second, when predicting or explaining psychological aging and development, the focus is on change processes and not on time-specific behavioral events; explaining long-term behavior-change processes may require modes of inquiry which are distinct from explanatory schemes developed for ahistorical and short-term analyses. Third, the search for causation is conducted within a context of metatheory; explanatory statements are different and evaluated differently within a mechanistic, organismic, personological, or ethological mode of conceptualizing behavior.

The decision on what is sufficient explanatory evidence is not an absolute one but monitored by metatheoretical perspectives. Consider, for example, Aristotle's specification of four causal determinants: material, efficient, formal, and final cause, with formal and final causes being explicitly teleological. Within a mechanistic concept of development, an adequate level of explanation is that of an efficient cause. An organismic concept of development, on the other hand, considers an efficient causal explanation incomplete (Bunge, 1963; Overton and Reese, 1973). For organicists, formal and final cause explanations are necessary to translate their assumption of an active organism into systematic efforts at theory building.

Similar perspectives apply to the unique requirements associated with other theoretical orientations (Kendler, 1970; Royce, 1970). Consider for instance the evaluative implications for the precision and scope of statements if ethological and personological approaches to explanatory evidence are contrasted. While a personologist may be satisfied with predictive statements of the behavior-behavior type (e.g., Erikson's stage of integrity follows the stage of generativity), an ethologist (e.g., Blurton Jones, 1972) would focus on evolutionary survival characteristics and organism-environment interactions as acceptable forms of explanation. Similarly, a researcher committed to an operant psychological orientation toward studying behavioral development (e.g., Baer, 1970, 1973; Bijou, 1970; Gewirtz, 1969; Hoyer, 1974) would only be satisfied if explanatory statements are available which specify the functional relationship between stimulus and response

conditions in a time-ordered and programmed fashion. Therefore, for a behavior process-oriented researcher, it is "open to question whether the study of developmental problems necessarily proceeds in the two-stage process of identifying age-performance functions and then explicating age in terms of its psychological meaning" (Baltes and Goulet, 1971, p. 152; see also Wohlwill, 1973).

Change-oriented Explanations. Although we need to recognize that the explanatory component of psychological theories of aging varies according to its theoretical and methodological context, there are some generic attributes. The major attribute is that a behavior-change focus requires a corresponding change perspective with respect to explanatory determinants and mechanisms.

When presenting a general taxonomy of prototheoretical questions and paradigms in research on development and aging, Baltes (1973b) used a behavioristic framework to illustrate the key element of a change-oriented explanatory posture. Figure 4 summarizes this illustrative approach and shows how behavior and behavior change can be explained by its relationship to different classes of antecedent variables.

American behaviorism has suggested the use of three classes of variables (e.g., Spence, 1963)

for psychological analysis: (1) response or behavior variables (R), (2) stimulus or environmental variables (S), and organismic or biological variables (O). The basic postulate is that a given behavioral phenomenon can be accounted for by reference to either other behavioral variables (R), stimulus-environmental variables (S), or organismic-biological variables (O) as antecedent determinants; however, in all cases the target phenomenon to be explained is a behavior (R).

The two elements of Figure 4 which are most crucial to the present discussion are its consideration of the *time continuum*, on the one hand, and of *changes in the variable system* on the other. First, it is shown that variable relationships can be either *concurrent* or *historical* in time. Concurrent explanations focus on determinants which are close or proximal in time to the phenomenon to be explained. Historical explanations focus on determinants or chains of determinants which are distal in time. For example, loss in intellectual functioning in advanced age could be explained by concurrent aging-specific conditions such as a reduction in cerebral blood flow (which would represent a proximal form of explanation). Conversely, the same loss in intellectual functioning could be explained by recourse to an early historical life event such as absence of aging-relevant educa-

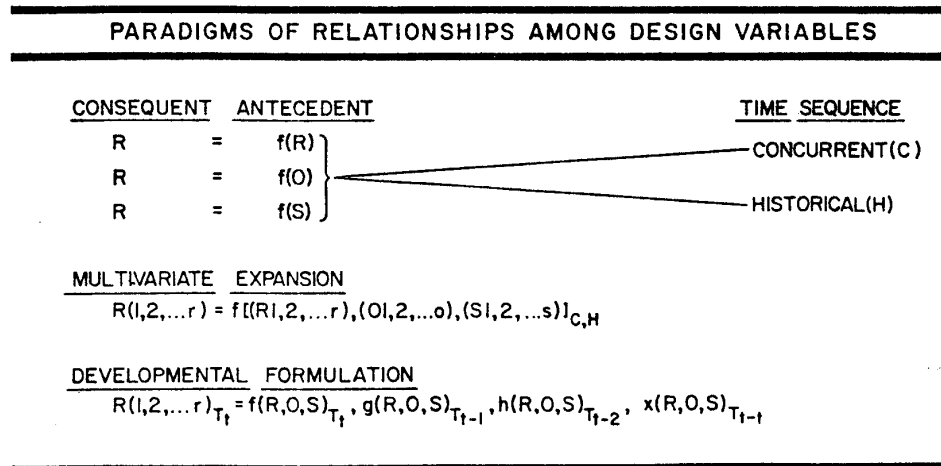


Figure 4. Prototypical paradigms and relationships among design variables in psychological and developmental research. (After Baltes, 1973b.)

tional experiences in childhood (which would represent a distal form of explanation).

Second, the emphasis placed in Figure 4 (see also Figure 3) on behavior-change analysis calls for explicating not only changes in the target behavior but also for explication of sequential effects of antecedent determinants. Change applies both to the consequent and antecedent side of the paradigm. It is the patterned accumulation or aggregation of effects which produces systematic behavioral change of the aging and developmental kind. The developmental change-oriented paradigm contained in Figure 4 illustrates one additional feature of a change-oriented explanatory analysis of psychological aging and development. This is the notion of *explanatory continuity vs. discontinuity* which asserts that either the same or a different set of antecedent determinants or the same or a different form of causal functions may exist at different stages or levels in the chain of antecedent-consequent events. First, different determinants (e.g., organismic versus environmental) may operate at different points in the behavior-change process. Second, the nature of the functional relationship between antecedents and consequents (*f* vs. *g* vs. *h*, etc.) or interaction among the determining antecedent variables may change.

For example, in the beginning of an aging chain, intellectual functioning may be largely related to early life educational experiences, whereas later elements in the chain may suggest that intellectual functioning is predominantly related to organismic-biological variables (reflecting a biological terminal drop phenomenon, etc.). An additional example of explanatory discontinuity is the postulate of structurally different processes (e.g., cognitive stages) for different levels of development. Kohlberg (1973), for instance, when presenting a life-span view of moral development uses explanatory discontinuity. He focuses on a biological-maturational explanatory orientation concerning moral development in childhood, but on an experiential explanatory orientation regarding adulthood changes in moral reasoning. As a final example, if one studies gerontological changes in personality as a consequence of environmental influences, the search for antecedents involves changing influence patterns. Neugarten's

(1968b) concept of age-grading is accordingly based on a time-ordered conception of antecedents for adult personality change.

The focus of a change-oriented explanatory posture, then, is on the notion of accounting for behavior change phenomena, such as aging, in terms of time-ordered (sequential) but potentially changing systems of explanatory determinants. In our view, the explicit recognition of change in both the target behavior phenomenon and its antecedent or correlated determining processes is at the core of such concepts as developmental continuity versus discontinuity, developmental stage, developmental chain, developmental task, or developmental interaction including the dialectic kind (Riegel, 1976 in press). A similar concern with explanatory sequentiality and discontinuity is also suggested not only by the increment in interindividual differences in intraindividual change with age, but also by the pervasive effect of cohort differences in aging (Baltes, 1968; Buss, 1973a; Riley, Johnson and Foner, 1972; Schaie, 1965, 1970). Cohort effects and large interindividual differences in aging probably do occur because the developmental, time-ordered matrix of determinants producing behavioral change in aging exhibits explanatory discontinuity among persons both in terms of the key variables involved as well as their interactive relationships.

Explanation of Psychological Aging: Evaluation of Present Knowledge

Figures 3 and 4 suggest jointly that (1) a multitude of antecedent variables and processes (e.g., behavioral, biological, environmental) can be used to construct a theory of developmental and aging change; (2) a process-oriented explanatory analysis has to incorporate a perspective of change not only with regard to the behavior change to be explained but also with regard to the class of antecedent variables and their interlocking functional relationships; and (3) current pluralism does not suggest the feasibility of single-agent explanations but the usefulness of considering contingency, multiple-factor, and system-factor explanations.

The assertion is that the level of precision, scope, and deployability of theories of behavioral aging and development are in the long run

not matters of untestable *a priori* assumptions but of empirical demonstration. If behavioral change in adulthood and aging could not be demonstrated to exhibit attributes of regularity and if the explanatory principles used to account for such changes could not be shown to involve systematic time-ordered, aggregated influence patterns, then a focus on change would lose its credibility as a viable and unique approach to the study of behavior in the aged.

Classes of Antecedents. Because of the intrinsic linkages between description and explanation, the main conclusions on the predominant postures in the literature regarding explanatory variables are similar to those offered regarding descriptive knowledge: (1) There is comparatively little explicit focus on developing explanatory models which could account for the pervasiveness of interindividual differences in aging change, (2) there has been an extraordinary concern with organismic (personological), biological, and endogenous rather than environmental variables, and (3) most prototheoretical explanatory attempts center on monistic, single-agent principles rather than on behavior-environment systems of multiple and discontinuous causality. Urban and Lago's (1973) summary of aging and developmental research on psychopathology, for instance, presents a persuasive case for these conclusions. The area of adult and gerontological intelligence (Baltes and Labouvie, 1973; Barton, Plemons, Willis, and Baltes, 1975; Jarvik and Cohen, 1973; Schaie, 1974) is another.

It is indeed encouraging to observe that the *chronological age variable* as the primary explanatory variable is on its way out. On the one hand, there is now overwhelming evidence questioning the descriptive and explanatory usefulness of age for methodological reasons. For example, interindividual differences in development and aging are remarkably large and can take multiple forms (see Wohlwill 1973). Moreover, with increasing age, less and less variance is age-associated but rather is related to age-irrelevant determinants such as life stress events (e.g., Dohrenwend and Dohrenwend, 1974; Lowenthal and Chiriboga, 1973) or cohort effects (e.g., Baltes, 1968; Schaie, 1965, 1970; Schaie and Gribbin, 1975). On the other hand,

there is also now widespread acceptance of the view that the use of age as an explanatory variable may inhibit vigorous theory building (even if made part of the dependent variable), in that age is a subject variable which is difficult to use for experimental-manipulative research (Baer, 1970; Baltes and Goulet, 1971; Birren, 1959b, 1970; Wohlwill, 1973).

At best, the study of age change can be seen as the first step in programmatic research as suggested by Wohlwill (1973, p. 40) or by the statement that age relations "are inevitably in transition to being explained by other variables without recourse to the use of the term age" (Birren, 1959b, p. 8). At worst, the use of chronological age as a primary antecedent variable is misleading to begin with, as it represents only an approximation to the identification of behavior-change functions and, due to its status as person variable (Kerlinger, 1964; Underwood, 1975), carries the risk of theoretical impotency. As Underwood (1975, p. 134) put it: "We cannot deal constructively with individual differences when we identify the important variables as age, sex, grade, I.Q., social status, and so on. The critical variables are process variables."

Figures 3 and 4 with their focus on pluralism also assist us in evaluating the *scope of antecedent variables* applied in current research. Taxonomies of variable systems are always arbitrary but usually involve some recognition of individual-biological, individual-psychological, cultural-sociological, and physical-environmental (Riegel, 1976) dimensions similar to the response variable, organismic variable, and stimulus variable distinction (Spence, 1963) presented earlier. For example, when jointly considering the potential import of biological and environmental determinants, several researchers (e.g., Baltes and Labouvie, 1973; Kastenbaum, 1967; Maddox, 1970; Schaie and Gribbin, 1975) have suggested that the bulk of explanatory aging research has addressed primarily the domain of biological variables even in areas where psychology has traditionally focused on the effects of experience. Environmentalism and experiential explanations are only recently surging to the forefront of explanatory research (Baltes and Lascomb, 1975; Bortner, 1967; Hoyer, 1973; Labouvie, 1973; Neugarten, 1968a). The distinction between

primary and secondary aging (Busse, 1959), suggesting a "primary" biological change function and "secondary" psychological or sociological change functions, is perhaps the best symbolic illustration of the traditional conceptual bias favoring a biological and/or medical model of explanation and reductionism as a prime mode of theory building.

A final evaluative comment regarding the nature of antecedent variables involves the need for multiple-factor and systems models and a consideration of both ontogenetic and evolutionary perspectives. While it is worthwhile to continue the search for key basic antecedents for the process of "normal" aging (e.g., on the level of neurophysiology; Botwinick, 1973; Busse, 1969; Hicks and Birren, 1970), it is also equally clear that the current explanatory literature on the psychology of adult development and aging does not support the notion of a monolithic, single-agent explanatory position. As Kastenbaum (1967) maintains, we need "to lift ourselves past the mental block that we are confronting a single and inevitable process which partakes of some formidable metaphysical reality" (p. 103).

In its search for a systems-oriented rather than single-agent explanation, gerontological research can profit from lessons learned in explanatory child-development research (e.g., Bronfenbrenner, 1973; Schultz and Aurbach, 1971). In the field of child development, it is now widely accepted that long-term behavioral change is controlled by a multitude of organismic and environmental variable systems and that time-ordered influence patterns operate and interact often in a disjointed and discontinuous fashion. As Benedict (1938) already argued quite some time ago, there is both continuity and discontinuity (descriptive and explanatory) in cultural-environmental influence programs as persons move through time. Recent evidence on gene-environment interactions (McClearn, 1970; Jarvik, 1975) suggests a similar perspective in research on behavioral and developmental genetics. Accordingly, we might not expect single-agent explanations to be likely but focus in our search during the next decade on multivariate and contextual (behavior-environment systems) patterns of determinants. It is at this point, where frameworks such as those suggested by

general systems theory (Bertalanffy, 1968; Buckley, 1968) can provide a useful perspective regarding the programmatic search for and identification of key classes of antecedents and their interactive relationships.

In any case, psychological theory on development and aging is in need of explanatory work which has more scope and balance regarding the universe of classes of antecedents used than has been true over the last two decades. At the same time, the vigor and persuasion for the recognition of environmental, multivariate, and ecological approaches expressed in Eisdorfer and Lawton (1973) signals a major reorientation in explanatory posture.

Systems and Taxonomies of Explanatory Processes. While we acknowledge the fact that the building of explanatory theories of development and aging is conducted within a metatheoretical and domain-specific context, Figure 5 is presented for the purpose of providing a framework for evaluation.

Figure 5 summarizes the view that both biological and environmental influences operate and interact in the production of behavior-change processes. The argument is made that a pluralistic approach—reflecting the preparadigmatic and prototheoretical situation in gerontological psychology—toward the formulation of explanatory models should be encouraged. Furthermore, the conclusion is that greater efforts are desirable in the direction of strengthening environmental, developmental-environmental, developmental-psychobiological, and ecological conceptions of behavior-change processes. Of particular significance in Figure 5, finally, is the resurrection of considering jointly the import of ontogenetic and evolutionary influence and change systems.

Figure 5 can also be interpreted as suggesting that the two foremost niches in explanatory theory building are in (1) the area of *interindividual differences* in behavior-change and (2) the lack of well-articulated conceptions of *long-term processes* aimed at organizing chains of gene-environment events and interactions.

With regard to the question of interindividual differences in change, the conclusion corresponds to that advanced in child development (Wohlwill, 1973) and educational learning re-

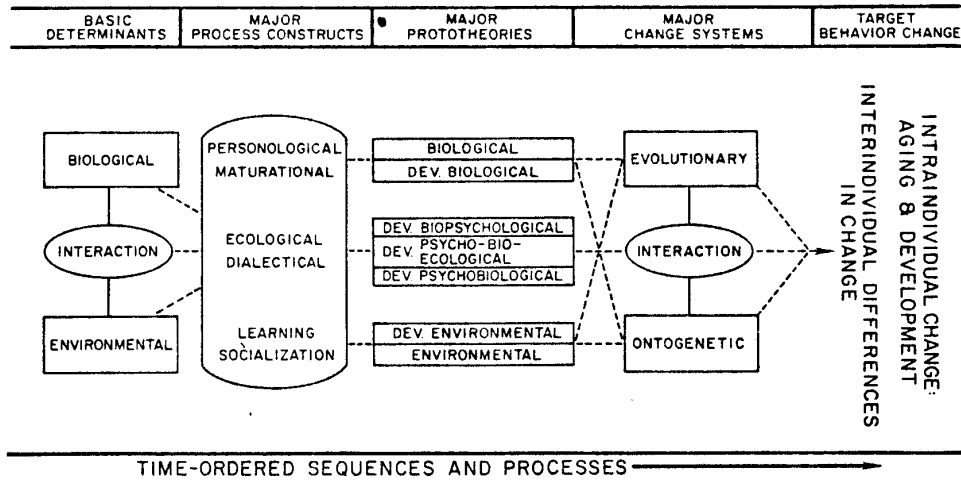


Figure 5. Illustration of major variables, processes, and theoretical orientations in the explication of psychological aging and development (interactive, reciprocal, and feedback influence patterns can be conceived at all levels of analysis).

search (Cronbach, 1975; Underwood, 1975). It is unlikely to expect theories which are satisfactory in precision, scope, and deployability until interindividual differences are not seen as sources for error but as primary targets for explanatory process-oriented analysis (see also Baltes and Nesselrode, 1973). This argument is further supported by the recognition of both ontogenetic and evolutionary-historical change components (Bengtson and Black, 1973; Buss, 1974b; Nesselrode and Baltes, 1974; Neugarten and Datan, 1973; Riegel, 1972, 1973a, 1976) which operate jointly in a rapidly changing bio-ecological context (see also Toffler, 1970). It is the fact of pervasive interindividual differences and of developmental level or age by treatment interactions which seriously restrict the immediate usefulness of such single-factor theories as Botwinick's (1973) stimulus persistence model, or Cumming and Henry's (1961; Bromley, 1970; Cumming, 1964; Havighurst, Neugarten, and Tobin, 1968; Maddox, 1964) disengagement theory.

As to the need for the articulation of long-term change processes, the search for basic mechanisms of the information processing and learning type seems in itself insufficient. To paraphrase Birren (1959b, p. 11), the issue remains that if much of gerontological research

does not intend to explicate a process of development, then aging subjects continue to be experimental constants leading to a parametric variation of principles formulated within a framework of general experimental psychology rather than to a psychology of aging. On the contrary, the focus of explanatory aging research is on change in both the antecedent and consequent variables and attention must be given to the formulation of explanatory processes which are intrinsically change-oriented.

For example, one of the simplest conceptions of long-term change explanations is to invoke quantitative and cumulative learning principles such as "cumulative practice," "cumulative extinction," "cumulative reinforcement" or "increments in stimulus persistence" in order to account for acquisition or reduction in performance throughout adulthood and aging. Such linear and cumulative conceptions of the behavior-change process, however, may not be sufficient for the purpose of explaining change phenomena of the structural and qualitative kind. In fact, this is the general view taken by strong developmental researchers, such as organicists (e.g., Langer, 1969; Overton, 1973). Alternatively, it may be preferable to explicitly focus on discontinuous and qualitatively distinct mechanisms.

In the area of cognition and learning, for example, change-oriented conceptions have been proposed which entail cumulative *and* hierarchical formulations of behavior-change (e.g., Bijou, 1970; Buss, 1973b; Gagne, 1968; Goulet, 1970, 1973; Hooper, Fitzgerald, and Papalia, 1971; Jensen, 1971; Riegel, 1973c). Similarly, Reese (1973) has argued that structurally different models of memory and information processing may be most useful for distinct periods of the life span; Baltes and Schaie (1973b) have suggested that an organismic (Reese and Overton, 1970) model of development may be most applicable to early life and terminal processes in late life, whereas ecological and environmental-dialectic models seem to fit most of the adult life period in human development. Woodruff (1973), when reviewing selected aging research on psychophysiology, concluded that discontinuous antecedent-consequent relationships are evident. Finally, LeVine (1969) examining the relevance of ontogenetic and evolutionary principles of explanation drew attention to the possibility of applying a Darwinian "variation-selection" model. He argued that this principle is apt to account for some of the adaptive behavior processes shown by adults in a changing biocultural context. These examples are presented to support the assertion that an explicit concern not only with time-ordered cumulative, but also with contextual, hierarchical, and discontinuous explanatory process-mechanisms is desirable in order to maximize success in developing adequate theories of psychological aging, involving both ontogenetic and evolutionary change perspectives (see also Bengtson and Black, 1973; Lambert, 1972).

Toward Modification of Psychological Aging and Development

It was argued earlier that psychological theories involve a balanced focus on knowledge generation and knowledge utilization. Accordingly, it is a legitimate goal to search for theories of aging and development which do not only explain an existing, naturalistically occurring set of behavior-change processes but also include statements about variables and strategies apt to produce alterations in existing aging outcomes. A number of contributions have appeared over

the last years (e.g., Baltes, 1973c; Birren, 1974; Birren and Woodruff, 1973; Bortner, 1975; Hultsch, 1975; Schaie, 1974; Schonfield, 1974; Urban, 1975) which have addressed or commented on issues of theory and method of intervention within a developmental and aging framework.

Metatheory and Intervention. Metatheories of development and aging set not only guidelines but also constraints for the design of intervention. Such metatheoretical constraints and guidelines involve statements about the potential *range* of modifiability, *goals* or optimization targets of intervention efforts, the scope of intervention *transfer* effects, *strategies* for the design of intervention programs, and the relative *desirability* of the intent to intervene. Second, a given theory of aging and development can be evaluated as to its intervention usefulness by considering its scope, precision, and deployability. Third, the conclusion holds that programmatic modification of behavioral aging and development is largely dependent on the extent to which explanatory research has resulted not only in internally-valid statements but also in statements with useful external validity.

Consider, for instance, metatheoretical constraints and guidelines imposed by accepting either an organismic model or mechanistic model of development as described by Overton and Reese (1973). On the one hand, when accepting a model of the organismic kind (Erikson, Piaget, etc.), there are useful prescriptions regarding the goal of intervention involving the domain and sequence (e.g., nature of psychosocial tasks and cognitive stages) of optimization. Such prescriptions (Kohlberg, 1968) are important in designing intervention programs with a view on programmatic consistency and on an active organismic-environment interchange. On the other hand, when accepting an organismic vantage point of the Erikson or Piaget kind, the anticipated range of modifiability is generally restricted due to the inherent focus on a pre-defined set of target (endstate-oriented) and sequential behavior-change processes and the theory-inherent preference for the optimizing power of inner-biological rather than experiential determinants (Riegel, 1976). Moreover,

Wohlwill's (1970a) organismic view goes so far as to conclude that only those behavior-change processes should be included under the heading development (or aging, the present authors infer) for which "the general course of development (considered in terms of direction, form, sequence, etc.) remains invariant over a broad range of particular environmental conditions . . . as well as genetic characteristics" (p. 52). Such a restrictive metatheoretical posture has far-reaching implications for the potential and design of explanatory research and correlated intervention efforts.

On the other extreme of a metatheoretical continuum are full-fledged mechanists and behavior designers (e.g., Baer, 1970, 1973) who are inclined to plan and implement developmental intervention with less information about the course and antecedents of development and relying largely on an arsenal of non-developmental intervention technology. It is a part of the mechanistic worldview in the behavioral sciences to focus primarily on concurrent and environmental paradigms and on target behaviors which are not related to a theoretically interrelated domain of development. Accordingly, interventionists of the mechanistic kind show less concern for the metatheoretical sacredness and/or power of a system of fixed and sequential regulatory principles of developmental behavior-change or for the contextual system of transfer effects (Bortner, 1975; Looft, 1973c; Willems, 1973). Similarly, the position has been taken by intervention-oriented social designers (e.g., Campbell, 1974; Studer and Stea, 1966) that there is little conceptual persuasion in the argument for and acceptance of "natural" systems. Therefore, becoming a planning culture and taking a vigorous approach to the design of development and aging is seen as being mandatory particularly in light of a rapidly changing ecological context.

It appears most likely that the application of both mechanistic and organismic approaches to behavioral intervention in aging will prove useful. This conclusion is in agreement with the position taken throughout this chapter that the current conceptual need in the field is one of a concerted but consistent *pluralism* in theory and method.

Theories of Aging and Intervention. The common position is to argue that a complete theory of psychological aging and development—including both descriptive and explanatory knowledge—is the key for successful intervention design. A complete theory would provide us with the necessary information about the course of behavior-change, the range of modifiability, goals of intervention, potential intervention transfer effects, and appropriate strategies of implementation and evaluation.

Descriptive and explanatory knowledge about aging processes indeed is the key prerequisite for sound intervention planning. The strength of a developmental approach to intervention (e.g., Baltes, 1973b; Brandtstadter and Schneewind, 1976 in press; Harshbarger, 1973; Urban, 1975) lies in comprehensive knowledge about the course and mechanisms of the developmental behavior-change process. Developmental knowledge permits a preventative design for optimization at all periods of the life span. In line with the arguments presented in earlier sections, the conceptual theme of a developmental approach to gerontological intervention is to recognize the contextual and process characteristics of aging as a behavioral phenomenon and to focus correspondingly on a contextual and process orientation in the design of interventional modification programs. A match between theory of development and intervention is a desirable goal.

Aside from the pervasive lack of adequate knowledge, however, the initial conclusion of aiming for a complete match between developmental-aging theory and intervention design needs modulation in light of additional issues.

First, there is the issue of *external validity* and evolutionary openness of any behavioral theory. Beyond the requirement that deployable knowledge needs an appropriate level of external validity, our position is that external validity of a behavior phenomenon is in principle unlimited and never completely marked or bounded by knowledge about existing phenomena. Recognizing that the potential range of psychological aging is not circumscribed both with regard to ontogenetic and evolutionary variation is particularly important, since the current biocultural context for aging may pre-

sent us with a highly selected view of aging phenomena. Therefore, a simple translation of knowledge about "naturally" occurring aging phenomena may make intervention impotent because of the culture- and period-centric nature of the knowledge base, i.e., its restricted external validity. It is for this reason that an outright commitment to intervention theory and methodology may result in *novel* knowledge about the range (external validity) of aging which researchers committed to explaining unobstructed phenomena are not apt to generate.

There is a second reason why modification efforts are not a simple translation of aging theory into intervention practice: Designing optimal development and aging is not always a simple optimization of the conditions which are responsible for a given developmental outcome. This issue involves the degree of *isomorphy* between the production of a behavior outcome and its modification.

Isomorphy in ontogeny and intervention design refers to the degree of similarity between the variables and mechanisms which produce an outcome and the variables and mechanisms which are apt to result in outcome alterations. Human behavior has been shown not only to be rather flexible but also often a function of multiple and diverse antecedents. Baltes and Nesselroade (1973, p. 220) stated such a multivariate and developmental paradigm assumption in the following manner: "Any dependent variable (or consequent) is potentially a function of multiple determinants . . . and any determinant or antecedent has potentially multiple consequents." A developmental approach to aging as outlined in this chapter explicitly maximizes the possibility of multivariate and discontinuous relationships as reflected for example in notions involving explanatory discontinuity and age by treatment interactions (see Baltes, 1973b; Sutton-Smith, 1970; Willems, 1973).

Intervention and Knowledge Generation. Efforts aimed at modifying psychological aging, then, do not represent only application and evaluation of knowledge (Urban, 1975) generated by the study of naturalistically occurring aging phenomena. Naturalistically occurring aging is but a subset of the potential universe of aging phenomena.

On the contrary, an intervention orientation can be a vital strategy for producing novel knowledge about the range of aging (and novel aging outcomes) if conducted within the framework of a programmatic approach (Baltes and Labouvie, 1973) toward theory building. Accordingly, intervention efforts represent an important vehicle for increasing knowledge (not only in the traditional interpretation of the significance of experimental methodology *per se*) about the external validity of aging phenomena. The nature of psychological aging changes not only with a changing biocultural context but also with the range of intervention programs which researchers and social planners are able to create.

We are impressed with the constraint and/or implicit pessimism shown by most psychogerontological researchers in regard to the potential plasticity and scope of aging behavior. At the same time, we reach the conclusion that the implicit reluctance of many psychogerontologists to engage in interventive research is one of the major reasons why our knowledge base on the psychology of aging is largely descriptive and restricted in scope and external validity. A clear acknowledgment of our historical and biocultural boundaries as well as an active belief in the open dialectics of ontogenetic-evolutionary change processes seems desirable. They may represent the most fertile conditions for future theoretical advances in the field and for the creation of psychological knowledge beneficial to future aging cohorts.

SUMMARY

The central themes of this chapter were treated in the context of metatheoretical and historical issues shaping concrete efforts at theory construction in the psychology of aging and development. Some of the key arguments and conclusions advanced are the following.

On Theory Construction and Theories of Behavior

1. The making of science involves the construction of theories which incorporate aspects of knowledge generation, knowledge dissemination, and knowledge utilization.

2. Theory construction in general proceeds within a contextual framework of meta-theories and metamodels of theory building and theories of behavior.
3. Theories can be evaluated in terms of precision, scope, and deployability.
4. Psychological theories of behavior are aimed at three interrelated objectives: the description, explanation, and modification of behavior.

On Theories of Psychological Aging and Development

1. Complete theories of psychological aging and development contain statements about the description, explanation and modification of intraindividual change and inter-individual differences in aging behavior.
2. All existing theories are of the prototheoretical kind and are incomplete or insufficient in precision, scope, and deployability.
3. Current research and theory construction need to become balanced and to reflect the pluralistic spectrum of current psychological theory and the diversity and multidirectionality of behavior-change phenomena observable in adulthood and aging; recognizing the impact of metatheoretical and cultural influences on the conduct of gerontological research is imperative.
4. The focus of psychological aging and development is on delineating behavior-change processes transcending a simple age-function approach; age functions are but a special case of behavior-change models.
5. Process-oriented approaches to psychological theories need to be concerned with the explication of historical, time-ordered sequences which go beyond concurrent paradigms both with regard to the description of change phenomena and their explanation and modification; this posture is known as the developmental orientation.
6. Large interindividual differences in gerontological behavior-change make monolithic, single-agent, and chronological age-related explanations not likely to be useful; the same is true for the likelihood of simple quantitative and continuous explanatory principles.

7. Modification of psychological aging is seen not only as a simple application and evaluation of existing basic knowledge; intervention work contributes to the generation of novel knowledge by delineating and expanding on dimensions of external validity of aging phenomena.

Niches in Theories and Prospects

1. Programmatic theory building is imperative in order to advance the field; currently, the psychology of aging does not offer much evidence of well-articulated theoretical frameworks.
2. Descriptive and explanatory research on behavioral aging and development need to focus on aging-fair approaches in order to produce a representative body of knowledge; emphasis on ecological and ethological methodology is desirable.
3. Knowledge about the plasticity and modifiability of aging behavior is scarce largely due to prescientific biases about aging and a correlated lack of programmatic inter-ventive research of the experiential kind.
4. Development and utilization of paradigms which explicitly center on biology-behavior-environment interactions appears promising; convergence of ontogenetic and evolutionary approaches to the study of aging change is also recommended.
5. Knowledge bases necessary for the design of optimal aging processes require concerted efforts aimed at constructing theory and research with a joint view on internal and external validity.

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