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The Warp and the Woof of the Developmental Fabric

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INTRODUCTION

The hope of tracking down significant relationships continues to lure many researchers into the hunt to understand development. The chase becomes all the more fascinating and absorbing as one appreciates its setting: the rich variety of phenomena comprising the patterns of change and stability witnessed over the human life-span. As with so many other psychological and behavioral phenomena, the more we learn about development, at whatever point or interval of the life-span we focus, the more we have reason to appreciate the limits of our understanding. Both substantively and methodologically, the apparent gains in understanding patterns of change and stability of the past couple of decades are interesting, yet there are few major trophies that we can sit back and enjoy at this point. Rather, it seems to be a time for renewed effort, to follow fresh ideas in novel directions and perhaps to turn away from paths taken earlier, the traces of which are no longer discernible as their promise seems now to be exhausted.

Purpose

My purpose in this chapter is to point toward some promising directions for developmental research as well as to contribute to further consolidation and growth of the knowledge base by identifying and attempting to integrate two established lines of research and theory, each of which deals with aspects of intraindividual change. The two, which will be defined below, are labeled *intraindividual change* and *intraindividual variability*. The research on intraindividual change on which I will focus includes the efforts stemming from life-

span developmental psychology (Bales, 1987) and life-course sociology (Elder & Caspi, 1990; Featherman, 1983; Riley, Johnson, & Foner, 1972) in order to understand the nature of developmental pathways and their differences and similarities among individuals. The study of intraindividual variability involves the conceptual formulations and empirical information emerging from research on relatively short-term, reversible change; what has been referred to, for example, as state (as opposed to trait) variation (see R. B. Cattell & Scheier, 1961; Horn, 1972; Luborsky & Mintz, 1972; Jones & J. R. Nesselroade, 1989; J. R. Nesselroade, 1987, for reviews). The weaving reference in the title was chosen to reinforce the idea of integration, rather than mere coexistence of the two kinds of intraindividual changes; manifestations of *both* are key constituents of our everyday lives.

I place considerable emphasis on measurement issues, an aspect too long neglected not only by developmentalists but by other researchers as well. These measurement issues lead to key research design and analysis considerations, some of which are identified subsequently.

I also want to say a word concerning what the chapter is not about. Bales, Reese, and J. R. Nesselroade (1977/1988) suggested that developmental research involves the study of interindividual differences (and similarities) in intraindividual changes. In other words, intraindividual change patterns are the basic "stuff" of development and the study of interindividual differences (and similarities) in such intraindividual change patterns essentially involves the application of the research methodologies of differential psychology to developmental change (J. R. Nesselroade, 1990). Wohlwill's (1973) insightful discussion of these and related issues remains a valuable guide to framing research questions and to answering them. In the spirit of "biting off less" and "chewing more" the focus of this chapter is restricted to the intraindividual change aspect of developmental research. I stop short of addressing interindividual differences and similarities in order to concentrate on intraindividual change phenomena. By differentiating between the two kinds of intraindividual change, I hope to strengthen that concept and thereby to help lay a firmer basis for the study of interindividual differences and similarities in intraindividual change in subsequent research.

Overview: Intraindividual Change and Variability

Figure 8.1 schematizes the two kinds of intraindividual phenomena (change and variability) on which the chapter is focused. Dichotomies cannot convey the richness that one might recognize and portray. This one, however, will suffice for our general purposes without bogging us down in unnecessary detail. The

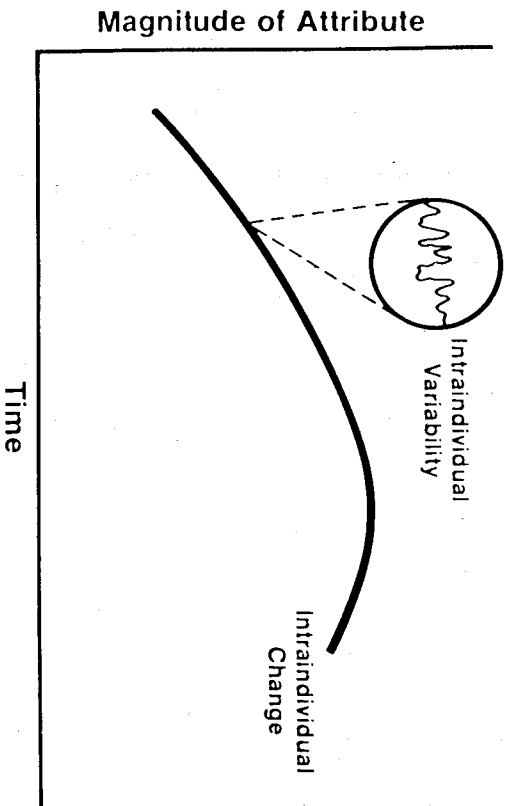


FIGURE 8.1. Schematic representation of intraindividual change and intraindividual variability.

two items of terminology that are key to the remainder of the paper—*intraindividual change* and *intraindividual variability*—are defined as follows (see also J. R. Nesselroade, in press; J. R. Nesselroade & Featherman, in press).

intraindividual change—more or less enduring changes that are construed as developmental by virtue of the nature of their antecedents, their consequences, and their correlates (Bales, 1987; Wohlwill, 1973).

intraindividual variability—relatively short-term changes that are construed as more or less reversible and that occur more rapidly than the intraindividual changes. J. R. Nesselroade and Ford (1987) described these phenomena as steady state "hum" and suggested that they be taken as a base condition of the individual against which to reference other aspects of intraindividual change and stability.

For most of the discussion to follow, several matters of *stability* are being set aside, although mention of them will be made in appropriate places. This is not to downgrade the importance of the concept nor to deny its role in understanding behavior. I believe, however, that stability is not going to be under-

stood very well until we measure and understand change somewhat better than we do now. For example, domains of measurement, such as human abilities, that are generally regarded as rock solid except for gradual intraindividual change (growth and decline) have been demonstrated to fluctuate coherently and systematically (manifest intraindividual variability) over short time intervals (Hertzog, Dixon, & Hultsch, 1989; Horn, 1966, 1972). In part because ability measures tend to correlate with themselves substantially over time, this kind of short-term intraindividual variability has been largely neglected. Evidence of the generality and pertinence of intraindividual variability, which is examined subsequently, has mounted to the point that it needs to be considered explicitly in measuring, designing research, analyzing data, and theorizing about the nature of developmental change and stability.

Organization of the Chapter

The first part of the chapter focuses on a description of intraindividual change phenomena. More specifically, I will emphasize development as studied from a life-span perspective. In the second part, concepts and some empirical research concerning short-term variability phenomena are presented. This involves recent research on various age groups, including older adults. The third portion of the chapter is devoted to a discussion and integration of concepts from the lines of intraindividual change and intraindividual variability research that I believe are promising for the advance of developmental research and theory. Some implications of the integration for further developmental research are then examined.

INTRAINDIVIDUAL CHANGE OVER THE LIFESPAN

The literature of life-span development of the past 20 or so years is replete with discussions of the putative nature of intraindividual change and the methodological issues that bear on further study and elaboration of its concepts (Baltes, Reese, & Lipsitt, 1980; Baltes et al., 1977/1988; Baltes & Schaie, 1973; Featherman, 1983; Goulet & Baltes, 1970; Hertzog & J. R. Nesselroade, 1987; Lerner & Hultsch, 1983; J. R. Nesselroade & Reese, 1973; Rowe & Kahn, 1987). Baltes (1987) presented an excellent summary of what life-span developmental psychology is about and a discussion of many of its implications for developmental research and theory. I will make liberal use of his representation to identify intraindividual change aspects of the life-span development portion of research and theory on which the subsequent discussion and integration presented in this chapter rests.

Perspectives on Lifespan Development

Baltes (1987) was explicit concerning several key aspects of developmental research. He argued that the field has (and should take advantage of) multiple perspectives and orientations toward the study of pertinent phenomena. The life-span orientation, he declared, is not the royal road to understanding development, but its theoretical propositions and empirical findings can greatly enrich developmental research. Baltes went on to say:

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 (p. 611)

Thus, Baltes identified a number of concepts that pertain to the life-span perspective on development. Most germane for the present discussion are four of the concepts that help to characterize developmental intraindividual change: multidirectionality, plasticity, developmental outcomes of gain and loss, and contextualism.

Multidirectionality. The course of development cannot be characterized accurately by sweeping generalizations of either growth or decline, regardless of the individual's age or stage of life. Attributes of the organism differ in the nature of the change manifested over time. Even during the same developmental periods, some characteristics are increasing while others are decreasing. Different developmental directions may show up at different levels of organization (e.g., cells, organs, habits) or in different kinds of functions (e.g., cognition, emotion). Diversity of direction may also obtain within the same levels of organization or kinds of functioning. Thus, the individual presents a rather complex profile of ongoing change and stability at any given point in time. Examined longitudinally, the picture becomes even more complex because of the different change possibilities manifested over various developmental paths.

Plasticity. An individual's actual developmental pathway is one particular realization of innumerable possibilities (Lerner, 1984). The concept of plasticity acknowledges different possible developmental paths, but the specific one taken is a product of the individual's potential and the experiences and conditions of his or her life. Determining the range and constraints of plasticity across content domains, ages, historical periods, and persons is a critical objective of developmental research.

Gains and Losses. In line with the multidirectionality conception, developmental outcomes do not consist of general, inevitable growth toward peak efficacy of all attributes and subsystems and then just as general and inevitable a decline toward their dissolution. All along the course of development gains are occurring in some respects while losses occur in others. It is both the content of the gains and losses and their relative magnitudes that are critical to apprehend and that provide the richness of diversity both within and among individuals.

Contextualism. Intraindividual change occurs in contexts: historical, cultural, societal, and so on. These various contextual strata influence the course of ontogenetic change through the conditions and events impinging on the individual. Contextual factors are themselves undergoing changes at varying rates and of differing generalities. Moreover, people are self-constructing (e.g., Ford, 1987) and are involved in selecting among possible contexts and producing new contexts to facilitate intraindividual changes (Lerner & Busch-Rossnagel, 1981). Thus, the developing organism is not an entity under transformation against a firm and invariant background but rather more an entity under transformation awash in a sea of change. Bales (1987) added that it is important to recognize limits on the variability dictated by both ontogenetic and contextual sources. The dominant picture is one in which levels of complexity are described as "dynamisms within dynamisms" (Featherman & Petersen, 1987) or "embedded hierarchies" (Ford, 1987).

Emphases and Requirements of a Lifespan Orientation

Thus, the life-span orientation provides a perspective on intraindividual change that seeks general lawfulness while emphasizing diversity, variability, complexity, and dynamic, rather than static, properties of the organism. The diversity stems from: (a) the variety of influences on the developing organism, (b) the variety of influences generated by the developing organism through its own functioning, and (c) the variety of effects that may result. The high level of complexity is indicative of the many systems and subsystems comprising an active organism and the demands placed upon it by the ever-changing context in which it functions. The recognition of various dynamic properties of the organism respects the diversity and complexity of developmental outcomes that obtain, and keep changing, across the life-span.

Obviously, capturing the complexity and diversity of the organism requires measurement schemes and procedures that are up to the level of complexity and sensitivity to change. These emphases dictate a set of sobering concerns that

need to be addressed in designing and conducting developmental research. In particular, they imply some profound burdens for the measurement, data collection, and modeling activities of developmental researchers. Let us consider some of them.

First, there is a rich supply of both antecedents (e.g., age-graded, history-graded, and non-normative life events) and outcomes (e.g., plasticity) of development. An appreciation (and incorporation) of the spectrum of possible influences, effects, and possible developmental pathways that an individual conceivably could experience irresistibly pulls one in the direction of multidisciplinary research. Thus, a reasonably comprehensive description of the human organism at any point in its life-span is going to be multivariate. Moreover, not just any subset of variables will do. The selection of variables for study in designing an experiment invites selection effects (J. R. Nesselroade, 1983, 1988). Selection effects, in turn, jeopardize conclusions regarding the organization of variables. Thus, the choice of variables for a given study should either reflect our best assumptions concerning how persons operate as organized entities or our best attempts to provide representative coverage of the domain of possibly relevant variables.

Second, developmental paths are typically estimated from a series of discrete measurement points. Apprehending the nature of intraindividual changes not only requires a sufficiency of measurement time points to detect and recognize change patterns but requires unusually *sensitive* measurement of attributes as well. There is a vast difference between drawing inferences about stability and/or change from measurements obtained with highly sensitive measuring instruments versus drawing them from measurements derived from instruments that were constructed deliberately to maximize test-retest stability (Vondracek, Lerner, & Schulenberg, 1986). Thus, longitudinal research designs of the appropriate frequency and interval of measurement are not themselves sufficient to the task of identifying developmental change. Measurement batteries used in those longitudinal designs must be composed of instruments that are capable of registering changes across time points. If, under those conditions an attribute is shown to be highly stable, one can construe the stability as a property of the concept being measured rather than a property of the way it is measured.

Third, because of the diversity of both developmental influences and the organism's capacity to manifest change, probabilistic representations of developmental processes over the life-span (e.g., Lerner, 1979, 1984) are necessary complements to deterministic ones. General statements concerning the course of development, desirable as they seem, are not apt to fit the individual case, given the wide range of influences on, and manifestations of, ontogenetic change. For

many attributes, one may need to develop characterizations of antecedent-consequent relationships in terms of properties of distributions rather than in relation to discrete events.

In summary, intraindividual change is complex, multidirectional, probabilistic, and does not transpire independently of its context. To study intraindividual change rigorously requires that attributes of the individual be measured at many points along the life-span. These measurements are the basis for constructing and studying the course of intraindividual change and should, therefore, be obtained from sensitive measurement procedures.

How should the individual be represented at each of these points in the lifespan? Is a profile of attribute scores that purport to characterize the individual's levels of growth, attainment, and so forth, to that point in time sufficient, or is there an alternative, perhaps more promising basis for the construction and elaboration of intraindividual change over the life-span? To begin to answer that question, I now turn to an examination of intraindividual variability.

INTRAINDIVIDUAL VARIABILITY PHENOMENA

Perspectives on Intraindividual Variability

Concern with intraindividual variability as manifested in the state part of the trait-state distinction has a long past, as was pointed out by Eysenck (1983). However, it has not occupied a major niche in the quantitative study of individual differences phenomena in the past century. On the one hand, intraindividual variability has been the primary focus of investigation for some researchers (R. B. Cattell & Scheier, 1961; Fiske & Rice, 1955; Jones & J. R. Nesselroade, in press; Luborsky & Mintz, 1972; J. R. Nesselroade, 1987; J. R. Nesselroade & Featherman, in press; Woodrow, 1932). On the other hand, as a sampling of remarks over the past four decades shows, intraindividual variability has also been a specter, sometimes at the forefront of consciousness, other times lurking at the edge, that bears directly on the measurement of a variety of attributes. For example, Torgerson (1958) describing Thurstone's judgment scaling model wrote:

Each stimulus when presented to an observer gives rise to a discriminial process. Because of *momentary fluctuations in the organism* [italics added], a given stimulus does not always excite the same discriminial process, but may excite one at a higher or lower value on the psychological continuum.... If we present

the stimulus to the observer a large number of times, we can think of a frequency distribution on the psychological continuum of discriminial processes associated with that stimulus. (p. 156)

In discussing the estimation of reliability within the framework of classical test theory, Gulliksen (1950) wrote:

...the major difficulty with reliability obtained by the successive administration of parallel forms is that it is too high. This is because there is no possibility for the variation due to *normal daily variability* [italics added] to lower the correlation between parallel forms. (p. 197)

R. B. Cattell (1966) said:

However, if a trait *fluctuates* [italics added] at all—and even a man's stature we are told varies slightly from day to day—then the widespread practice of taking a single occasion measurement and calling it a trait measurement is wrong. (In practice, it may even be morally wrong, as when we measure an individual's IQ on a single occasion and allot or do not allot a scholarship to him on the basis of that result.) (p. 357)

Hundtoby, Pawlik, and R. B. Cattell (1965) wrote:

Although R-technique (individual differences study) itself is commonly regarded as dealing with traits the fact is that *any individual's score at a given moment is a combination of trait and state influences* [italics added]. The variance we analyze in R-technique is the sum of inter and intra individual i.e., over time differences. The only way to escape from major contamination by the latter is to measure each person several times and use his *average score* [italics added] in the R-technique analysis. (p. 5)

Jack Wohlwill (1973) said:

... change rather than stability is the norm, even if only in a random or cyclical sense. (p. 23)...That *averaging* [italics added] results in a loss of information is hardly more than a truism; the question is whether the information lost represents true information, or merely noise. (p. 140)

Horn (1966), describing the outcome of an analysis of intraindividual variability in human ability measures concluded:

Perhaps the principal value of this study is to be found in the research strategy adopted. This was directed at defining functional unities in terms of several conceptions about what might constitute a 'unity' and what is meant by 'functional.' The results illustrated how fluid intelligence (as well as other attributes of intellectual test behavior) *varies functionally within persons* [italics added] and also represents a stable pattern of performances that distinguishes one person from another. (p. 47)

Finally, in my local newspaper, one not uniformly noted for its informational content, an insightful meteorologist and guest editorialist (Hosler, 1988), writing about climate and weather said: "There is no 'normal' weather or climate—only *highly variable* [italics added] weather and climate." (p. A-6)

These quotations contain three key ideas which will be developed further shortly. First, for many behavioral and psychological attributes, there is a distribution of values possible for the individual. A person will manifest only one of those values at a given measurement instance, and that value will depend on conditions, setting, measurement technique, and so on, but the fact remains that the measurement obtained is one particular realization of many possibilities. Such a notion is scarcely new in psychology. It is consistent with formulations as diverse as classical test theory (Gulliksen, 1950), Vygotsky's "zone of proximal development" (see Ferrara, Brown, & Campione, 1986, for a review) and Hayek's proposals for representing complex phenomena such as human behavior (Weiner, 1982). Second, in lieu of the specific values at a particular time, estimates of parameters of those distributions of possible values can be used to characterize the individual. Third, whether or not distributional parameters such as means and variances should be used to characterize the individual depends upon the appropriateness of that parameter for the purpose, and on the quality of the estimate. A single observation, for example, may not provide a very precise estimate of the mean although, in actual research practice, it is doubtless the estimate most frequently used. Moreover, the mean of a distribution with a large variance, however well that mean is estimated, is not very informative about a value at one particular time.

Research on Intraindividual Variability

Rather than passing off intraindividual variability as "error," averaging it out, or ignoring it altogether, some researchers began, quite a long time ago, to try to measure its extent and ascertain its significance in a variety of domains (R. B. Cattell, A. K. S. Cattell, & Rhymer, 1947; Thouless, 1936; Woodrow, 1932). For over 40 years researchers have been conducting intensive-measurement

(many variables, many occasions) studies of the short-term (often day to day) variability in individuals (e.g., R. B. Cattell et al., 1947). Earlier studies of this kind were reviewed by R. B. Cattell and Scheier (1961), Fiske and Rice (1955), and Luborsky and Mintz (1972). Jones and J. R. Nesselroade (1989) surveyed a number of intraindividual variability studies conducted since the 1970s.

In the context of the trait-state distinction (R. B. Cattell & Scheier, 1961; J. R. Nesselroade, 1987; Spielberger, Gorsuch, & Lushene, 1969), intraindividual variability research has helped to build an appreciation for the diversity and richness of description that characterizes the individual as he or she exists at one point in time. One's state levels are involved in determining one's behavior just as surely as are one's trait levels, even though simple prediction models obviously favor the latter because of their (implied) stability over time. The essential idea is that individuals have many attributes, some of which are relatively stable, other of which are not, and yet, at a given moment, both kinds of attributes are involved in characterizing the person and in helping to determine his or her behavior. Moreover, "state" is in part a function of the set of variables to which it is linked at a particular time. The placement of steel bars between oneself and an adult lion, for example, can turn a state of panic into one of awe and admiration. Thus, to understand better the contribution of person characteristics to the prediction of behavior, one needs to apprehend both the more or less stable and more or less changeable attributes of the individual.

In the past three decades, the multivariate, repeated measures evidence for the coherence of intraindividual variability has mounted substantially. In addition to research in domains traditionally tied to intraindividual variability, conceptions such as affect, emotion, and mood (Corneal & J. R. Nesselroade, 1988; Lebo & J. R. Nesselroade, 1976; Zevon & Tellegen, 1982), other work involves the study of intraindividual variability in domains that are quite different from each other, but that have been assumed to reflect more or less stable personality attributes (intraindividual differences). Included are human abilities (Horn, 1966), self-concept (Hooker, 1988), locus of control (Roberts & J. R. Nesselroade, 1984), temperament (Hooker, D. W. Nesselroade, J. R. Nesselroade, & Lerner, 1986), teacher performance (Hundley & Gluppe, 1981), and work values (Schlenberg, Vondracek, & J. R. Nesselroade, 1988). Hundley et al. (1965) argued for the recognition of intraindividual variability in essentially all of the major personality dimensions.

The results of the studies just mentioned indicate that for many different kinds of psychological attributes there exist coherent, systematic patterns of fluctuation (intraindividual variability) that are defined over relatively short intervals of time (e.g., day to day, week to week). That is to say, the intraindividual variability is not just random error or "noise" but, rather, variability

indicative of changes of state in the organism. The magnitude of the variance of these intraindividual variability patterns can, in fact, be quite substantial, as we will see further on.

What is the primary implication of the evidence that coherent intraindividual variability rather than a single true score is the base condition of the individual for measurement and analysis in conducting developmental research? To be blunt, to the extent that a condition of coherent intraindividual variability instead of fixed true scores surrounded by error variance provides an accurate portrayal of the individual at a given time of measurement and one's purpose requires that degree of accuracy, then the intraindividual variability representation should be used.¹ That, in turn, suggests important modifications in measurement, research designs, and data analysis procedures as noted above.

Most of the research on intraindividual variability has involved young adults. Work currently underway with older adults on which I now report briefly also supports the validity of an intraindividual variability representation. This opens up some important possibilities for the study of adult development and aging to which I will return.

The Cornwall Manor Study

David Featherman and I are collaborating on a study of intraindividual variability in older adults for which data collection has recently been completed (Nesselroade & Featherman, in press). The site of data collection is a comprehensive retirement community, Cornwall Manor, located at Cornwall, PA, near Hershey, PA. The study, which was funded by the MacArthur Foundation Research Network on Successful Aging, involved some 60 Cornwall residents. Average age of the participants was approximately 78 years. Measurement foci included biomedical, cognitive, mood/state, attitudinal, and physical functioning variables. Half of the participants were measured weekly for 25 weeks. The other half ("controls") were measured at the beginning and again at the end of the 25-week period. The study is intended to answer a number of questions about the scope, magnitude, and structure of short-term variability in the elderly.

The data to which I want to call attention are simple variability statistics that we have obtained in our initial attempts to describe the events of the measurement period. The variability statistics are presented in Table 8.1 for individual items from the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977), a self-report screening device. They include intraindividual variability estimates obtained by computing each individual's variance on the week-to-week measures and then averaging these intraindividual variability indices across only those individuals who showed any variation in their week-to-

TABLE 8.1
CES-D Item Variances

Item	*Intraindividual Variability (Weeks 1-25)	†Interindividual Differences	
		First Occasion	Last Occasion
felt depressed	.22 (14)*	.17	.20
everything an effort	.20 (22)	.34	.34
sleep restless	.22 (24)	.40	.41
felt happy	.16 (16)	.11	.23
felt lonely	.15 (11)	.20	.23
people unfriendly	.08 (6)	.00	.14
enjoyed life	.21 (14)	.00	.24
poor appetite	.17 (11)	.43	.38
felt sad	.15 (17)	.10	.21
felt people disliked me	.10 (7)	.24	.20
couldn't get going	.18 (20)	.33	.25

*Intraindividual variability was computed separately for each individual over their weekly measurements. Column entries are averages over people.

†Interindividual differences variances were computed on same individuals as are reflected in column 1 using their first and last measurements.

The number of cases on which mean intraindividual variability is computed. Responses of the rest of the treatment group did not vary over time on the item. Some colleagues have argued that analyzing only the data provided by varying individuals inflates the magnitude of the estimates of intraindividual variability in a misleading way. This is why the intraindividual differences estimates are based only on those same varying individuals. Clearly, if the values of the individuals who manifested no variability were included in the averages, the intraindividual variability estimates would be smaller. One of the fundamental points of this paper, however, is that averages may not be very meaningful in some cases. Putting the zeroes of the non-varying subset into the averages of intraindividual variability seems to be such a case.

week responses. These values are presented in column 1. Not all participants registered variability on all items, but for the same subset of persons who manifested week-to-week variability, separate among-persons variances were computed at the first and last occasions of measurement to estimate interindividual differences. These values are presented in columns 2 and 3. What these item statistics show is that the magnitude of the intraindividual variability for the individuals who manifested it at all is one half or more of the magnitude of their interindividual differences variances at either the first or last occasion of measurement. To examine the implication of this comparison, consider the simple model, described by Equation 1, which says that observed score (X) at a given time consists of a *stable* trait component (T), a state component (S), and an error of measurement component (E) or,

$$X = T + S + E. \quad (1)$$

The variance of X at a given point in time would be composed of the variances and covariances of the components as shown in Equation 2.

$$\text{Var } (X) = \text{Var } (T) + \text{Var } (S) + \text{Var } (E) + 2 \text{Cov } (T,S), \quad (2)$$

assuming no correlation between substantive components and error. Thus, in addition to trait and error variance, the interindividual differences variance at a given occasion of measurement (columns 2 and 3) includes state variance and twice any state-trait covariance. The entries in column 1 reflect state and error variance only. Assuming, for simplicity, that error variance within persons is of the same magnitude as that between persons, a comparison of column 1 entries with column 2 and column 3 entries suggests that the state variances tend to be at least as great as the trait variances across the CES-D items. Straightforwardly interpreted, *those individuals who manifested intraindividual variability tended to differ from themselves over time about as much as they differed from each other at a given time*. Doubtless these variance comparisons will differ widely across domains and variables, but those found here for CES-D items help make the point that many individuals do not maintain the same profile or configuration of attributes from one time to another. This, in turn, raises the possibility that the way the individual interacts with his or her environmental context is mediated in a more complicated way than is implied by traditional trait-oriented prediction and explanation schemes that consider only highly stable attributes of the individual.

INTRAINDIVIDUAL VARIABILITY AS THE BASE FOR INTRAINDIVIDUAL CHANGE

Two lines of intraindividual research have been examined. It is my contention that information about both is necessary for an adequate description of the nature of the individual at a given point in time. Accepting that, it is argued that both kinds of information should be considered in relation to the goals of developmental research. Moreover, the two should be considered jointly, rather than in isolation from each other. How might this be accomplished?

A Proposal

What do the concepts and the data I have reviewed suggest? The essential idea that I draw from them (see also J. R. Nesselroade & Ford, 1987) is that instead of conceptualizing the individual as a rather static package of more or less stable true scores that change only relatively slowly and gradually according to developmental (and learning) principles, the individual should be thought of as a dynamic, labile, fluctuating, changing entity, *some* of whose attributes are relatively stable over time but change developmentally.

There are two key aspects of the above statement that I want to separate. First, it implies that the full characterization of the person at a given point in time requires knowledge of the current values of all of his or her attributes, both relatively stable and varying ones. Second, some of the relatively stable characteristics of the individual may be the parameters of the distributions of his or her intraindividual variability dimensions. Thus, the first aspect is illustrated by the following: Jones, the extraverted salesman, is feeling somewhat anxious today as he calls on his customers, whereas yesterday he was relatively carefree. In much of his psychological makeup, he is the same Jones yesterday and today, but the arrival of a notice informing him of an upcoming audit of his income tax returns by the IRS which arrived yesterday afternoon has altered him in other respects. The impact on Jones of an event such as a "fender-bender" would doubtless differ, depending on whether it happened yesterday or today. Or, if asked to make some policy recommendations for the next sales period, his responses would likely be quite different depending on which day he thought about them.

The second aspect of the intraindividual variability and change distinction is illustrated by, for example, Jones's anxiety swings being somewhat less pronounced now than when he was a younger man; that is, he has become "mellow," as it might be described in today's vernacular. In other words, the

variance of Jones's distribution of anxiety levels has shown intraindividual change as he has grown older. This exemplifies the notion of a trait-like attribute (e.g., variance) of state-like dimensions.

To the extent that the parameters of intraindividual variability distributions (means, variances, upper and lower bounds, etc.) can change over time, those very parameters are candidates for developmental research. Therefore, one proposal being advanced is that intraindividual changes in the parameters of intraindividual variability distributions become a focus of research on developmental pathways. Thus, for example, to study intraindividual changes in, say, temperament dimensions, the means of the intraindividual variability distributions of those dimensions could be estimated and analyzed over time. Moreover, not just the means but other distributional parameters of interest should be estimated

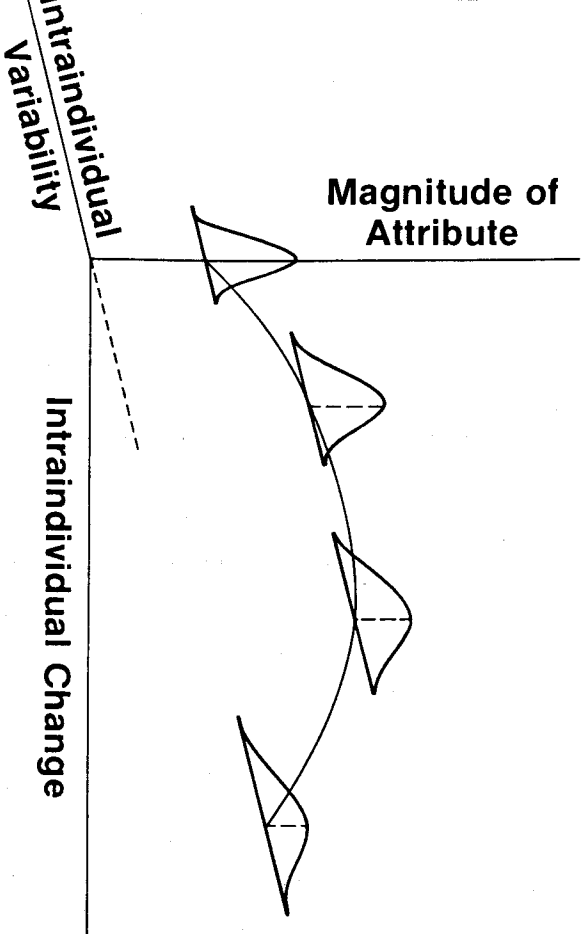


FIGURE 8.2. Representation of intraindividual changes in intraindividual variability distributions.

and studied in relation to intraindividual change. Variance changes, in particular, may prove to be critical to capturing the nature of adult development and aging.² Some of these possibilities are illustrated in Figure 8.2.

Note that the perspective offered here does not rule out high levels of stability (traits) because intraindividual variability around a mean (one's "true" score) could be quite small. In such cases, a single measurement (the usual approach) provides a close estimate of the mean of possible values for the individual. I want to emphasize, however, that an attribute should not uncritically be assumed to manifest high stability. Rather, stability and the conditions of its maintenance should be foci of empirical examination.

This proposal has a special pertinence for students of individual differences because it suggests that the *parameters* of the distributions of scores across time and within persons (e.g., means and variances, higher moments, boundary values) provide useful information about interindividual differences (and similarities). Indeed, some researchers have identified a trait as the mean of the distribution of state scores over time (Patterson & Bechtel, 1977; Zuckerman & Lubin, 1965). Other parameters of such distributions (e.g., the variance) may turn out to be as much or even more useful than means and offer interesting possibilities for other domains of differential inquiry, such as behavior genetics (Plomin & J. R. Nesselroade, 1990).

From a developmental research perspective, it is important to note that in many ways this proposal does not really represent a radical departure from current practice. Rather, it identifies more explicitly what developmentalists have been doing (but often not very well), and puts it in a more general context. What is typically done in, say, longitudinal research is a special (and quite limited) case of this more general scheme. That is, a single measurement of an attribute is taken at each time point and regarded as an estimate of true score. Changes in these measurements are then examined and interpreted developmentally. A single assessment of an attribute, however, does not convey information about intraindividual variability. The proposal advanced here explicitly recognizes the intraindividual variability character of behavioral attributes of interest and focuses developmental inquiry on its various parameters.

A loose analogy can be drawn between the intraindividual variability parameters reflecting the momentary descriptions of the person and the probabilistic conceptions of attributes of subatomic particles, emphasizing distributions of possible values rather than a specific one at a particular moment. Recognizing the differences between predicting where a specific leaf will fall and predicting the eventual distribution of leaves around the tree also illustrates the point. After a specific leaf has fallen, its location can, of course, be specified just as we can

measure a person's level on some attribute at a given moment of our choosing. *The utility of specific occasion values versus general ones has to be determined in relation to one's purposes and intended use of the information.*

The Fabric Analogy

Using the proposal to plot developmental change in terms of the parameters of intraindividual variability distributions, let us now consider, in more detail, the analogy referred to in the title. The texture, strength, pattern, and character of cloth is supplied not just by the long threads (warp), not just by the cross threads (woof or weft) but, rather, by the combination of the two, interlaced as they are in the process of weaving. The parallel I want to draw is between the nature of intraindividual change and the warp and between the nature of intraindividual variability and the woof. Just as both kinds of threads are equally involved in the process of weaving, both kinds of intraindividual phenomena appear to be involved in defining the fabric of development. These ideas are illustrated in Figure 8.3.

Because of intraindividual variability we cannot be certain in advance of an event what an individual's configuration of attribute levels will be when the event occurs. Therefore, we cannot be certain in advance how he or she will react to that event and thus what its long-term consequences will be. Yet, *it seems clear that the particular configuration of attribute levels of the individual at the time an event occurs mediates the effects of that event and helps determine its aftermath.* This notion is evident in many areas of scientific inquiry and application including work on risk and protective factors, state-dependent performance, and clinical practice. Joan Erikson (Erikson & Erikson, 1981), for example, contrasted people to materials such as wood, vis-a-vis their predictable attributes and emphasized a major difference: "Materials and objects aren't moody...." (p. 265-266) R. B. Cattell (1980) has developed formal models for representing this general idea in the context of development and learning. Referring back to Cattell's (1966) example mentioned earlier, a person who gets a scholarship because of scoring well on an IQ test may owe the subsequent benefits that accrue throughout his or her life as a function of the scholarship to having taken the test on a "good" day rather than a "bad" one. Or, in view of research findings concerning the possible relationships between performance and time of day (e.g., A. D. M. Davies & D. R. Davies, 1975), one might distinguish between "good" and "bad" segments within a given 24-hour period. Alternatively, the person who has a breakdown because of the stress involved in seeking an advanced degree, the pursuit of which was made possible by a scholarship, may

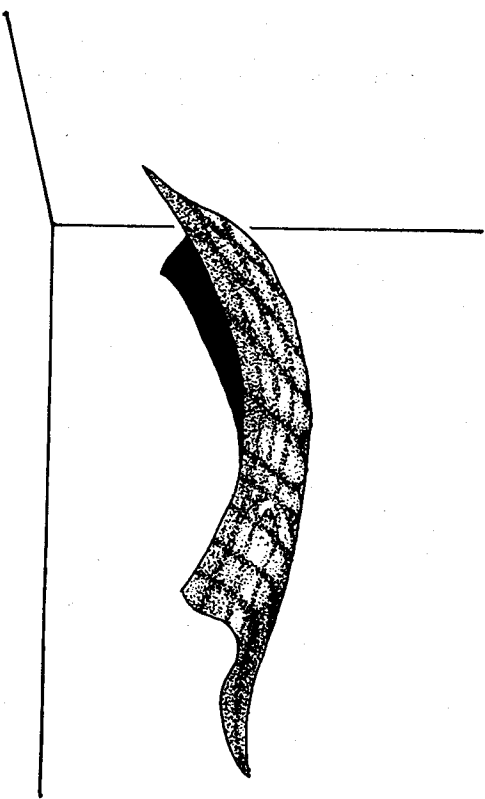
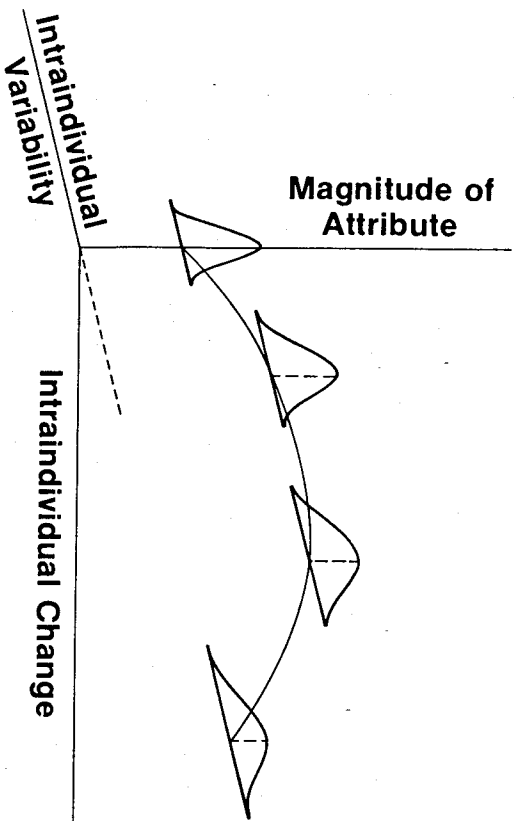


FIGURE 8.3. The warp and woof of development's fabric.

owe that and subsequent misfortunes to a relatively transient set of conditions in play at the time of taking the selection test. Thus, we visualize a developmental pathway not as a set of lines projected over time but as a surface, as sketched out in Figure 8.3. That surface has some of the character of cloth, character dependent for its definition not only on the warp of intraindividual change but also on the woof of intraindividual variability.

Some Substantive Implications

The intraindividual variability conception offers an array of possibilities for attending to intraindividual change concerns. Commensurate with the diversity and complexity of developmental outcomes, intraindividual variability conceptions offer a more elaborate basis for the representation of individuals. The attributes of interest to developmentalists can differ greatly within intraindividual variability distributions. Attributes of low or even no intraindividual variability (the classical trait conception of stable interindividual differences) can be included meaningfully as limiting cases in which the obtained score accurately represents the distribution of possible values at that point in time. Concurrent with stable attributes, those of considerable intraindividual variability are brought into the framework of developmental research. Thus, both trait- and state-like attributes fit within this general scheme. Without the ability to characterize the individual thoroughly at a given occasion of measurement, the descriptions one attempts to form across occasions of measurement—for example, developmental pathways—are limited, impoverished statements of the individual and will most certainly lead to inadequate accounts of developmental change.

To focus the discussion we will consider the four concerns of lifespan development discussed already: multidirectionality, plasticity, developmental outcomes as gains and losses, and contextualism, in light of intraindividual variability concepts.

Multidirectionality. Typically, multidirectionality has referred to changes in the individual's level on an attribute. Bales (1987) indicated that individuals manifest diverse patterns of increases and decreases on attributes over their lifespans. The notion is equally applicable to the means of intraindividual variability distributions of attributes of individuals. Moreover, in addition to means, the variances, boundary values, and other distribution parameters may show increases or decreases compared to their values at earlier points in the lifespan. As an individual ages, for example, he or she may become more variable on some attributes (e.g., acute health problems) and less variable on others (e.g., tolerance). Thus, to the extent that greater among-persons variation

is found in older than younger individuals, it could be attributable to increased intraindividual variability because, as represented in Equation 2, among-persons variance reflects intraindividual variability. Again, this does not represent a radical departure from current thinking, only an elaboration of the possibilities.

Plasticity. By its very nature, intraindividual variability signifies an initial or "prototypic" plasticity. The magnitude of intraindividual variability appears to be great enough, at least for some attributes, to support an expectation of differential longer term effects of various life events on the individual, depending on the individual's configuration of attributes at the time an event occurs. The probabilistic representation of the individual's attributes over time and the idea that the particular configuration of attribute values of the individual at the time of some particular event mediates the effect of that event on subsequent development is compatible with the conception of many possible life-span pathways for the individual. It seems to be much less of a conceptual leap to move from steady state "hum" (J. R. Nesselroade & Ford, 1985) to greater changes such as are implied by the concept of plasticity, than to move from the concept of a configuration of stable traits to plasticity. Thus, what is being subjected to the internal and external influences that help to shape the organism is not a lump of clay but, rather, a vibrant, somewhat labile organism that is already pulsating to a multitude of rhythms. The further shaping of intraindividual changes by amplification and attenuation processes is superimposed on these intraindividual variability patterns.

Gain/Loss. The additional possibilities that an explicit focus on intraindividual variability brings to the consideration of the gain/loss dynamic described by Bales (1987) include two that bear explicit mention here. The first is the elaborated definitions of gains and losses that are made possible. For example, increased intraindividual variabilities on some attributes can be construed as gains in that they may signify greater adaptive capacity, whereas decreased intraindividual variability on others may be seen as gains because it signifies increased regulation and control. Similarly, there are more possibilities for defining loss. The second sense in which intraindividual variability brings enriched meaning to the concept of a gain/loss dynamic is that the gains/losses "value" for a given individual at a given time is subject to intraindividual variability because its defining components are.

Contextualism. Given that one conceptualizes the developing individual as located in a changing context and that each influences the changes in the other (Lerner & Busch-Rossnagel, 1981), this primary conception of intraindividual variability raises some interesting possibilities concerning both the impact of context on ontogenesis and vice versa. In concept, states are inherently sensitive

to the effects of contextual factors (Hertzog & J. R. Nesselroade, 1987). The influence of a particular contextual factor or event may differ from one individual to another depending on their respective profiles of attribute scores at the time of pertinent events. Similarly, the nature of intraindividual variability may mediate the impact that the developing individual has on his or her context. For example, in some circumstances, consistency and stability may lead to a more noticeable impact on one's environment than lability. In other circumstances, the reverse seems to hold. Popular lore, for instance, asserts on the one hand that persistence, even in the case of moderate abilities, pays off in the effort to modify the status quo ("If at first you don't succeed..."). That same lore, on the other hand, suggests that there are times when we should "go with the flow."

In sum, the argument has been advanced that intraindividual variability is an important part of the nature of the individual, that it is coherent and meaningful rather than "noise." It mediates the effects of environmental events just as it is amplified and attenuated by them. Thus, theoretical accounts of development and developmental change need to incorporate intraindividual variability if they are to capture the richness and complexity of intraindividual change.

Some Methodological Implications

The proposal to substitute intraindividual variability distributions for single scores as a focus for developmental inquiry has a number of methodological implications. We will group them around the scheme of measurement, design, modeling, and data analysis issues.

From a measurement perspective, there is a concern with being able to measure attributes of the individual with sufficient sensitivity to register change and intraindividual variability. Measuring instruments that have been constructed to measure state dimensions, for example, can (and in many cases should) show high reliabilities at each time of measurement and low test-retest correlations between times of measurement (J. R. Nesselroade, Pruchno, & Jacobs, 1985). By contrast, measuring instruments that have been constructed to measure putatively stable attributes may be composed largely of items deliberately selected for high test-retest stability. Such instruments do not seem to be fair candidates for use in studies aimed at assessing intraindividual variability and change.

From the standpoint of design, the frequency of measurement becomes a key issue. The accurate assessment of intraindividual variability seems to require repeated measurements, some of which occur over short time intervals. The assessment of intraindividual change also requires measurements repeated over intervals suitable to the objectives of one's inquiry. Thus, until there are better

alternatives for assessing intraindividual variability, longitudinal research designs need to be planned around successive "bursts" of measurements rather than merely successive measurements. That is, at each time of measurement in a longitudinal design, one needs to be able to estimate parameters of intraindividual variability (means, variances, etc.) if they are to be the focus of developmental investigation.

Finally, with regard to data analysis and modeling, there is a clear need for statistical models geared to the representation of both intraindividual variability and intraindividual change processes within individuals. Methods developed by McArdle (1982) and Molenaar (1985), for example, represent an important step toward this end. Until we have the tools necessary to represent intraindividual variability and change adequately, we will not be able to address the study of interindividual differences (and similarities) in intraindividual change patterns in a satisfactory manner.

CONCLUSION

The distinction between intraindividual variability and intraindividual change and their integration into a characterization of developmental change emphasizes the concepts of diversity, complexity, and change. At the same time, this is not to deny order and regularity; only to ask about the level of abstraction at which they can be found. Years ago, in characterizing the nature of similarities and differences among individuals, Kluckhohn and Murray (1953) decreed that "every man is in certain respects like all other men, like some other men, like no other man" (p. 53). Paraphrasing Kluckhohn and Murray, from the perspective of lifespan development (and with due regard for gender), it might be said that, "at a given time, a person is in certain respects like himself or herself at all other times, at some other times, and at no other time."

The threads of intraindividual variability are firmly interwoven with those of intraindividual change, resulting in a fabric whose mysteries are not as easily unraveled as are those contained in a handful of mere loosely twisted strands of attributes measured over time. This representation offers a basis for genuine diversity as well as lawfulness, just as it also challenges the resources and ingenuity of the researcher. To the extent that it fairly represents the course of development, however, accounts of ontogenetic change must deal fairly with it.

NOTES

1. To the extent that the intraindividual variability representation applies, it supports the reasonableness of Epstein's (e.g., Epstein & O'Brien, 1985) and others' proposal to aggregate individual's scores over occasions (e.g., compute an average value) to improve *general* predictions. However, the use of averages over occasions impoverishes the representation of an individual at a given time of measurement and that may be critical for understanding the onset and subsequent nature of some life-course changes. Traditional modes of predictions aside, at this point it seems more appropriate to think of development as relatively continuous over time rather than discrete over blocks of time, especially if the blocks of time are aggregated somewhat arbitrarily. Aggregation smooths out some of the "bumps," perhaps, but from a developmental perspective, there are important differences between the person "averaged" over several times of measurement and the person to whom specific events happen at particular times.
2. To the extent that interindividual differences variation on a given attribute increases with age, the information presented here implicates increased intra-individual variability (asynchronous across individuals) as a possible explanation.

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9 The Interface Between Emotion and Cognition

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The Western mind is full of dichotomies and linearities. It is difficult for us to break down domains like cognition and emotion so powerfully articulated and so long ago established. Our theories separate emotion and knowledge, and we claim that even if they are related, it is only in the simplest manner. For example, most argue that emotion is the consequence of thought; thus, to paraphrase Descartes, passion is the sweat of thought. Such a view has its modern theoretical counterparts: The theory of emotion associated with Schachter and Singer (1962) holds that emotions are simply the by-product of an organism's general arousal and the attributions regarding such arousal made in a specific context. In this theory, thought is "real," while emotion is only an epiphenomenon of thought. This treatment of emotions as epiphenomena is most common in theories of emotion.

Although some theorists believe that emotions themselves are not only real but may lead to or drive thought, their theories are less well articulated than the others'. Emotions are generally considered to be motives that may lead to or organize thought, but only rarely are emotions described as the processes which create thought. For only a few are emotions the source of thought. In short, the predominant Western understanding is that thought creates emotion but emotion does not create thought.

The possibility that we cannot separate knowing from emotion is the theme of this chapter. It is difficult for us to reconcile, on the one hand, the belief that emotion is an epiphenomenon of cognition and, on the other hand, the view that

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Joachim F. Wohlwill
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