

Longitudinal Methods

LONGITUDINAL RESEARCH

Developmental scientists often argue that lawful relationships in human development can only be understood if the *same* organism is observed over the time frame during which the developmental phenomena of interest is thought to occur. This article identifies those aspects of aging research that require longitudinal inquiry; it also calls attention to some methodological pitfalls that limit longitudinal work from being the design of choice in all circumstances. More detailed discussions of longitudinal research methods may be found in Baltes and Nesselrode (1979) and in Schaie (1983, 1996). Extensive recent presentations of major longitudinal studies of adult development may be found in Busse (1993), Schaie (1996), and in Shock, et al. (1984).

Advantages of Longitudinal Studies

The primary advantage of the longitudinal approach is that it offers information on intra-individual change (IAC). Cross-sectional studies, by contrast, allow inferences only about inter-individual differences (IED). Five distinct rationales can be attributed to the longitudinal study of aging organisms:

Direct Identification of Intraindividual Change.

Intraindividual change may be quantitative and continuous or may involve qualitative change, such as the transformation of one behavior into another. In either case, determination of change requires observation of behaviors over more than one occasion. When cross-

sectional data are used to estimate IAC, it must be assumed that (1) subjects of different ages come from the same parent population at birth; (2) subjects have been matched across age levels for all characteristics other than age and the dependent variable, and (3) different-aged subjects have experienced identical life histories. Such assumptions are quite unreasonable in studies with human subjects.

Identification of Interindividual Variability in

Intraindividual Change. Determination of different patterns of growth and decline requires the examination of similarities and differences in developmental trajectories. Data from longitudinal studies provide information on the degree of variability displayed by different individuals in their behavioral course over time that is needed for the construction of growth or decline typologies. Only longitudinal data allow the determination whether group parameters accurately describe changes in any particular individual. The valuable hypothesis-generating method of single-subject research, therefore, depends upon longitudinal observations.

Interrelationships Among Intraindividual Changes. Modern aging research operates within a multivariate context. Following individuals over time allows the discovery of constancies and changes not only in individual variables but also in structural patterns that describe the relationship among these variables. The multivariate

longitudinal approach is essential for the identification of progressive differentiation and dedifferentiation processes .

Analysis of Determinants of Intraindividual Change.

Longitudinal studies identify time-ordered antecedent-consequent relationships. It is the longitudinal approach alone that can uncover causal processes that involve discontinuities, such as the so-called sleeper effects.

Analysis of Interindividual Variability in the Determinants of Intraindividual Change. Longitudinal data, finally, allow inferences concerning the problem that many individuals show similar patterns in IAC that are determined by different change processes. For example, different change processes may occur at different levels in the range of talent, or different permutations of causal sequences may lead to similar outcomes in groups having different demographic attributes

.Pitfalls of Longitudinal Studies

Longitudinal studies do not conform to the rules for true experiments since age is a subject attribute that is not randomly assignable. Such studies are subject, therefore, to all the problems common to quasi-experimental research designs (Schaie, 1988, 1996). A threat to the internal validity of longitudinal studies that is of particular concern is the confounding of age and historical effects (what may appear to be maturational normative change may be the consequence of time-limited secular trends). Because the traditional longitudinal design

is a special case of the pretest-posttest design, other validity threats include the effects of testing, instrumentation, statistical regression, experimental mortality and selection (Schaie, 1988, 1996). Longitudinal studies also share certain limitations with respect to generalizability. Concerns here involve *experimental units*, the extent to which data collected on one sample can be generalized to another; *experimental settings*, the extent to which findings have cross-sectional validity; *treatment variables*, limitations imposed by measurement-implicit reinforcement schedules; and *measurement variables*, the appropriateness of task characteristics at different developmental stages as a longitudinal study progresses. In spite of these concerns, most of which are shared by age-comparative (cross-sectional) research, longitudinal data remain essential for the purposes described above. Some of the enumerated design problems can be handled by the use of suitable control groups and/or use of sequential strategies involving multiple cohorts (see Schaie, 1988).

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