The Relationship Between the Structure of Interindividual and Intraindividual Variability: A Theoretical and Empirical Vindication of Developmental Systems Theory

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Abstract
Proponents of the developmental systems theory (DST), like Gottlieb and Lerner, have questioned the relevance of behavior genetics for the study of developmental processes. In this chapter, the criticism of DST will be reformulated in a way that is consistent with Wohlwill’s thesis that the study of developmental processes requires analysis of intraindividual differences, not interindividual differences. The reasoning is straightforward: (1) behavior genetics is a branch of applied multivariate statistics, conjoined with simple and uncontroversial Mendelian laws of inheritance; (2) standard multivariate statistics, including (developmental) behavior genetics, is based on analysis of interindividual differences; (3) the results of an analysis of interindividual differences of a given phenotype may not be related at all to the structure of intraindividual differences of the same phenotype; (4) developmental processes give rise to intraindividual variation and also interindividual heterogeneity. From the above reasoning, the reformulated conclusion of DST follows.

In this chapter 1 and 2 above will be taken to be self-evident. As to 4, a concise appeal to the mathematical statistical literature will suffice to show that developmental
processes constitute a subset of the class of dynamical systems, where the standard definition of a dynamical system is given in terms of a collection of time-dependent distribution functions characterizing the structure of within-system (that is, intraindividual) variation over time. This leaves open the possibility of introducing additional specifications concerning between-system (interindividual) variation of the time-dependent within-system structure. The main part of the chapter will be devoted to a defense of 3—namely, that the results of an analysis of interindividual differences may not be related at all to the structure of intraindividual differences.

The hypothesis that an analysis of interindividual variation yields qualitatively the same results as an analysis of intraindividual variation of the same measures is known in mathematical statistics as the ergodicity hypothesis. The classical theorems about ergodicity show that it holds only in case a process is strictly stationary—that is, the collection of time-dependent distribution functions characterizing the process has moments that are constant in time. This implies that developmental processes, which almost by definition have at least some moments that vary in time, are nonergodic and that for these developmental processes there is no relationship between analyses of inter- and intraindividual variation.

In a simulation study, it will be shown that behavior genetical factor analysis of interindividual variation can yield results that are entirely unrelated to the structure of intraindividual variation of each of the subjects making up the sample. The psychometrical and practical consequences of this finding are discussed at some length.

In the final part of this chapter, it will be indicated how a more valid analysis of nonergodic intraindividual variation by means of time-series analysis techniques like dynamic factor analysis can be carried out. A simple inductive methodology, new in the behavioral sciences, will be sketched with which lawful relationships generalizing over genuinely homogeneous populations of subjects can be derived.

Introduction

From a very general perspective, developmental psychology can be conceived of as the study of ontogenetic trajectories across the lifespan, including their similarities and their differences (Baltes, Reese, & Nesselroade, 1977; Nesselroade & Ghisletta, this volume). The life history of each individual is thus depicted as a path in a high-dimensional behavioral space, while a population of subjects defines an ensemble of such age-dependent paths. Although this is a rather abstract picture of the domain of developmental psychology, it has the merit of bringing into focus a longstanding theoretical debate about the proper way to study developmental processes. This theoretical debate concerns the question of whether the pattern of interindividual variation within an ensemble of life histories at some point in time contains sufficient