

Metatheoretical Features of Behavior Genetics and Development

Willis F. Overton

Gilbert Gottlieb's continuing contributions to our understanding of the role of genetic activity in development are explicitly rooted in a developmental systems framework. This framework, which is fundamentally metatheoretical in nature [Overton, 2003a], asserts that the individual organism constitutes an active self-organizing system that grows through the co-action or transaction of individual parts – initially genes-environment – in a manner that is nonlinear in nature. The nonlinear or epigenetic character of this growth means that with development the system becomes transformed; novel features and novel levels of functioning emerge, and these cannot be reduced to (i.e., completely explained by) earlier features. Thus, the genetic-environmental system transforms through action into the cellular-environmental system, and then into the organ-environmental system, and ultimately the person-environmental system. Population behavior genetics, on the other hand, has traditionally operated without clearly articulating the metatheoretical frame that contextualizes its functioning. As a consequence, it has often been portrayed as an assumption-free scientific method aiming to simplify complexities and arrive at a partitioning of variances into one component labeled 'heredity' and one labeled 'environment.'

The characterization of population behavior genetics as a scientific method free of metatheoretical constraints is both false and misleading. It is false because any scientific inquiry operates within some metatheoretical frame. A metatheory provides basic constructs that articulate the meaning of concepts and methods in the field of investigation. A metatheory offers guidelines, and criteria for decisions concerning the nature, and the adequacy or inadequacy of the methodological approach being taken. A metatheory prescriptively defines what is meaningful and what is meaningless, what is acceptable and unacceptable, what is central and what is peripheral to inquiry.

Population behavior genetics as free of metatheoretical constraints is misleading because it creates the illusion of hard science in the face of less than hard thinking. It is misleading because it fosters the attitude that various assertions are virtually self-evident and beyond rational critique. For example, it encourages a belief that the statistical concept of 'heritability' implicates genes or demonstrates 'genetic effects,' while arguably it doesn't. It promotes a conviction that twin, fam-

ily, and adoption studies demonstrate ‘the influence of genetic factors,’ and that these designs are ‘genetically informed designs,’ while both assertions are highly debatable. It fosters a conviction that complexity demands simplification through the use of reductionistic additive models, while this conviction is arguably false. And it sponsors the demonstrably false belief that the honorific title of ‘behavior scientist’ belongs to those who accept the beliefs of population genetics while critics pursue ‘ideology-as-science.’

Gottlieb’s central thesis in this paper, as well as in his earlier work [e.g., Gottlieb, 1995; Gottlieb, Wahlsten & Lickliter, 1998], is the claim that a contemporary scientific understanding of the contributions to development of biology generally and genetics specifically requires the abandonment of the metatheoretical assumption of additivity. I completely agree with Gottlieb on this point as well as on those points that are derivative of this. However, because the issue of additivity is so central to all facets of the contest between developmental systems approaches and population behavior genetics approaches I will direct most of my comments to this assumption, and will try to contextualize its place as a metatheoretical principle. I will also reserve a few lines for a related topic that I believe needs an elaboration in Gottlieb’s general schema; the focus on the individual.

Additivity derives from a split metatheory that originated with Descartes, was nurtured by the Newtonian world view, and developed through the epistemologies of positivism and neo-positivism [Overton, 2002]. Split metatheory entails several basic defining principles, including ‘splitting’, ‘foundationalism’, and ‘atomism’. *Splitting* is the separation of components of a whole into mutually exclusive pure forms or elements. But, in order to split one must accept the twin principles of *foundationalism* and *atomism*. These are the metatheoretical axioms that there is ultimately a rock bottom unchanging nature to reality (the foundation of foundationalism), and that this rock bottom is composed of elements – pure forms – (the atoms of atomism) that preserve their identity regardless of context. Additivity enters the picture here through a corollary principle that all complexity is *simple complexity* in the sense that any whole is taken to be a purely *additive* combination of its elements.

From the perspective of this metatheory any behavior or behavioral change is necessarily (i.e., must be understood as) an aggregated manifestation of two pure bedrock forms – biological elements and environmental elements. Because these are pure forms or essences [Oyama, 2002] they can only combine additively (or multiplicatively). Moving to the level of methodology this means that the first task of any split driven investigation is a descriptive one of reducing the complexity (*reductionism*) to arrive at this bedrock. In population behavior genetics this task is assumed by the statistical heritability index that Gottlieb criticizes. The second task of this methodology is that of finding the causal linkages between the two forms and the behavior under consideration. Here too, however, as both von Bertalanffy [1968] and Bunge [1962] pointed out long ago, traditional analytic procedures and the very idea of split causality require the concept of additivity or linearity. ‘Nonlinearity entails a failure of causality, since the effects can no longer be decomposed into a sum of partial effects every one of which can be traced to individual events ...’ [Bunge, 1962, footnote, p. 168]. It should be noted finally that – whether considering the descriptive or causal task – the additive corollary is always reflected in the linear components-of-variance statistical model from which derive

the univariate and multivariate analysis-of-variance, and correlational designs. As Hayne Reese and I pointed out, also long ago,

‘The basic assumption of this model is that each score is a linear function of independent elements, i.e., the score is the sum of component effects ... Although interaction effects reflect nonadditivity of the main effects ..., the interaction effects combine additively with the main effects to determine the score. Furthermore, the interaction effects are themselves linear, since they are defined as population cell means minus the sum of main effects (plus the population base rate)’ [Overton & Reese, 1973].

This then is the broad metatheoretical frame that contextualizes and prescribes the operations of population behavior genetics. It is a metatheory that prescribes that the role of genes in behavior must be some variation of the formula Behavior = Biology + Environment; that any ‘system’ or behavior must, like any whole, be considered as a simple aggregate of elements; that a statistical outcome termed ‘heritability’ must implicate genes; that twin, family and adoption data must demonstrate the influence (causality) of genetic factors. If the critics of population behavior genetics are ideological in their stance, they are no more so than supporters.

At an equal level of generality the alternative to split metatheory has been termed relational metatheory [Overton, 2003a]. This inclusive metatheory subsumes the metatheoretical principles of any general systems approach, as the latter apply specifically to living organisms. Relational metatheory begins with the rejection of pure forms or essences, and consequently with the rejection of splitting, foundationalism, and atomism. More positively, relational metatheory begins with the principle of *holism*; the assertion that the identities of objects and events derive from the relational context in which they are embedded. Here, the whole is not an aggregate of discrete elements, but an organized and self-organizing system of parts, each part being defined by its relations to other parts and to the whole. Complexity in this context is *organized complexity* [Luhmann, 1995; von Bertalanffy, 1968], in that the whole or system is not decomposable into elements arranged in additive linear sequences of cause-effect relations [Overton & Reese, 1973]. Non-linear dynamics are a defining characteristic of this type of complexity. The other principles of relational metatheory, including (a) the identity of opposites, (b) the opposites of identity, and (c) the synthesis of wholes, have been discussed in detail elsewhere [see Overton, 2003a, b]. Here it is sufficient to state the first two of these relational principles operate in a fashion roughly analogous to Escher’s famous figure ‘Drawing Hands’ in which a left and a right hand assume a relational posture according to which each is simultaneously drawing and being drawn by the other. Each hand is identical with the other in the sense of each drawing and each being drawn. At the same time each hand preserves its own identity in the sense of there being a left and a right hand. In this relation, neither is foundational and yet each maintains an identity.

With a focus on the identical nature of opposites, behavior, traits, styles etc. cannot be thought of as being decomposable into independent and additive pure forms of genes and environment. There can be no question about which of the parts of a whole is more basic, or ‘how much’ each contributes to the whole. Thus, from the perspective of relational metatheory, the goals of population behavior genetics simply represent a meaningless approach to inquiry. The percentages derived from the application of heritability statistics, whatever their value, can never be taken as

a reflection of the separate contributions of genes and environment to individual differences because the relation of genes and environment (a left Escherian hand and a right Escherian hand) is not independent and additive. Further, the relational causality discussed by Gottlieb holds. That is, the notion of *identical* opposites concretizes the meaning of any truly non-additive reciprocal determination [Overton & Reese, 1973]. Genes and culture, like culture and person, and brain and person etc., operate in a truly *interpenetrating* manner, and further, any concept of *interaction* (e.g., interaction, co-action, transaction) must be interpreted not as the cooperation, competition or combination among elements, but as the *interpenetration* among parts.

The *opposites* of identity switches the focus to the fact that, despite their identical nature, any pair of basic antinomies do maintain their oppositional quality, and hence each member of the pair maintains its own identity. The left hand is the left not the right, and the right is the right not the left. This principle establishes relatively stable platforms (e.g. genetic or biological platform, cultural or environmental platform, person platform) from which to launch scientific inquiry. Thus, it is reasonable and ultimately necessary to begin at a *standpoint* or *point-of-view* (left hand or right hand) to conduct empirical investigations, provided there is recognition that complete understanding is constituted only by the integration of all standpoints, and consequently no one or two standpoints have priority or are foundational. This principle contextualizes Gottlieb's argument [see also Lerner, 2003] for the necessity of systematically examining the role of genetic activity in development, but doing so without introducing a theoretical reductionism. Understanding is found in the unity of standpoints, not in their reduction.

The principle of the synthesis of wholes establishes that a resolution to the oppositional yet identical quality of antinomic pairs must be found in the way these are, or become, coordinated. This principle has both a synchronic and a diachronic dimension. Synchronically, the principle asserts that oppositional terms find integration or coordination as wholes through a third superordinate term. For example, biology and culture find their integration in the psychological person; person and culture find their integration in biology; and person and biology find their integration in culture. The diachronic dimension references the change process from oppositional parts to integrated whole. Change here is dialectic and synthetic. Oppositional parts constitute a self-organizing action system. The co-action of parts operating in a nonlinear context moves towards synthesis or reintegration. Each synthesis itself constitutes a novel self-organizing action system and, consequently, further movement towards synthesis. Within the context of this metatheoretical principle development becomes understood, as described by Gottlieb, as a multi-leveled epigenetic process, which gives rise to non-reducible novelties at each level of synthesis.

The purpose of this brief excursion into the metatheoretical was designed to demonstrate that the issue of additivity has deep roots and broad implications. As Gottlieb's work attests, the stance one assumes in relation to this issue as a metatheoretical issue impacts significantly on how one might transform behavior genetics from a purely statistical enterprise to one that seriously considers the nonlinear role that genetic activity plays in the development of the individual.

Closely related to the issue of additivity is Gottlieb's insistence 'in order to study and understand the development of the individual it is necessary to study the

individual as such.’ This and associated statements made by Gottlieb are completely consistent with relational metatheory. The person, the individual, the psychological subject represents a level of synthesis and a standpoint that is as necessary to understanding behavioral development as is the biological level and the cultural-environmental levels. And yet Gottlieb omits the level of the individual from his figures of the levels of bidirectional causality (fig. 7 and 8). In an earlier publication Gottlieb and his colleagues [Gottlieb, Wahlsten & Lickliter, 1998] argued that the person level is unnecessary because ‘psychological functioning or mediation (perception, thinking, attitudes, love, hate, etc.) must be inferred from analysis at the overt level of behavior and the environment [p. 241].’ It is, of course, the case that all mental functioning must be inferred from behavior, but only the most radical behaviorist – not a methodological behaviorist – would claim that, therefore, mental events should not be considered a determinant of behavior. Denial of the person level goes back to the time of neopositivism when ‘inferred entities’ were considered illegitimate features of the explanatory process. To continue such an argument would essentially deny the whole cognitive revolution and the enormous methodological advances that have occurred over the past 50 or so years. Further, and more critically in terms of the coherence of Gottlieb’s own work, if this justification were to stand then it would negate much of his more general argument. All levels of analysis or levels of synthesis involve the coaction of observation and interpretation, and if this were not the case many of the central concepts that define Gottlieb’s position here, and in other works (e.g., system, organization, pattern), would themselves be judged to be scientifically illegitimate.

The omission of an individual person-centered standpoint as one of several complementary and necessary research standpoints is also inconsistent with Gottlieb’s own endorsement of several projects [e.g., Bergman, Cairns, Nillson, & Nystedt, 1999; Magnusson & Törestad, 1993] that do, in fact, take this standpoint [see also Overton, 2003a, b]. The endorsement and inclusion of a person level to the levels of bidirectional causality would, thus, ensure the coherence and consistency of Gottlieb’s general argument, and would add weight to the suggestion that ‘in order to study and understand the development of the individual it is necessary to study the individual as such.’

References

- Bergman, L., Cairns, R.B., Nillson, L.G., & Nystedt, L. (Eds.) (1999). *Developmental science and the wholistic approach*. Mahwah, N.J.: Erlbaum.
- Bertalanffy, L. von (1968). *General system theory*. New York, N.Y.: George Braziller, Inc.
- Bunge, M. (1962). *Causality: The place of the causal principle in modern science*. New York, N.Y.: The World Publishing Co.
- Gottlieb, G. (1995). Some conceptual deficiencies in ‘developmental’ behavior genetics. *Human Development*, 38, 131–141.
- Gottlieb, G., Wahlsten, D., & Lickliter, R. (1998). The significance of biology for human development: A developmental psychobiological systems view. In R. M. Lerner (Ed.), *Theoretical models of human development*. Volume 1 of the Handbook of child psychology (5th ed.), Editor-in-Chief: William Damon. New York, N.Y.: Wiley.
- Lerner, R.M. (2003, in press). Genes and the promotion of positive human development: Hereditarian versus developmental systems perspectives. In C. Coll, R. Lerner (Eds.), *Nature and nurture: The complex interplay of genetic and environmental influences on human behavior and development*. Mahwah, N.J.: Lawrence Erlbaum Associates.
- Luhmann, N. (1995). *Social systems*. Stanford, Calif.: Stanford University Press.

- Magnusson, D., & Törestad, B. (1993). A wholistic view of personality: A model revisited. *Annual Review of Psychology, 44*, 427–452.
- Overton, W.F. (2002). Understanding, explanation, and reductionism: Finding a cure for Cartesian anxiety. In L. Smith, & T. Brown (Eds.), *Reductionism* (pp. 29–51). Mahwah, N.J.: Lawrence Erlbaum Associates.
- Overton, W.F. (2003a). Development across the life span: Philosophy, concepts, theory. In R.M. Lerner, M.A. Easterbrooks, & J. Mistry (Eds.), *Comprehensive handbook of psychology: Developmental psychology* (volume 6). Editor-in-Chief: Irving B. Weiner. New York, N.Y.: Wiley.
- Overton, W.F. (2003b, in press). Embodied development: Ending the nativism-empiricism debate. In C. Garcia Coll, E. Bearer, & R. Lerner (Eds.), *Nature and nurture: The complex interplay of genetic and environmental influences on human behavior and development*. Mahwah, N.J.: Lawrence Erlbaum Associates.
- Overton, W.F., & Reese, H.W. (1973). Models of development: Methodological implications. In J.R. Nesselroade, & H.W. Reese (Eds.), *Life-span developmental psychology: Methodological issues* (pp. 65–86). New York, N.Y.: Academic Press.
- Oyama, S. (2002). The nurturing of natures. In A. Grunwald, M. Gutmann, & E.M. Neumann-Held (Eds.), *On human nature: Anthropological, biological, and philosophical foundations* (pp. 163–172). New York, N.Y.: Springer.