

Cognitive-Developmental and Behavior-Analytic Theories: Evolving into Complementarity

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Key Words

Action theory · Behavior analysis · Cognitive development · Metatheory · Worldviews

Abstract

Historically, cognitive-developmental and behavior-analytic approaches to the study of human behavior change and development have been presented as incompatible alternative theoretical and methodological perspectives. This presumed incompatibility has been understood as arising from divergent sets of metatheoretical assumptions that take the form of ontological and epistemological principles, and constitute worldviews. Classically, cognitive-developmental approaches have been cast as deriving from an organismic worldview and behavior-analytic approaches from a contextualist worldview. Previous attempts at uniting the two approaches have entailed privileging one and radically modifying the other. The present paper argues that a meaningful integration requires a set of metatheoretical assumptions that transcends both worldviews, and, while maintaining their distinct qualities, unites them. This metatheoretical framework termed relational metatheory is described and its integrative implications explained.

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Historically, cognitive-developmental and behavior-analytic approaches to the study of behavior change and development have been presented as incompatible alternative theoretical and methodological perspectives. This presumed incompatibility has been understood as arising from divergent sets of fundamental ontological and epistemological assumptions (i.e., assumptions about the nature of the world, and about how this world can be known), often known as metatheoretical assumptions, or – at the highest levels of generality – worldviews. For years, at least as a partial result of this presumed incompatibility, research scientists within each tradition have tended to declare the victory of their own vision, and ignore or marginalize the methods, findings, and interpretations of the other. As a consequence, even the somewhat antagonistic debates that once fueled much of the empirical productivity of each tradition have long since past, and have been replaced by a traditionocentric isolationism.

Recent advances in the philosophy of science [e.g., Latour, 1993; Putnam, 1992; Taylor, 1995] and in the analysis of metatheoretical assumptions [Overton, 2003] have opened the door for rethinking this issue of incompatibility, and this rethinking, in turn, suggests a potential integration of the two traditions. This new direction is contextualized by a movement away from flirtations with searches for an absolute or even probabilistic certainty, an elimination of foundational antinomies, and the embracing of a general relational dynamic system perspective. The aim of this paper is to explore the nature and some of the potentials of this new direction as it specifically applies to two of the historically most productive approaches to the study of behavior and development.

Piagetian cognitive-developmental theory and Skinnerian behavior-analytic theory constitute two systems that historically have widely been judged both incommensurable and contradictory [Overton & Reese, 1973]. When examined through the lens of worldview assumptions such as those articulated by Steven Pepper in his seminal work *World Hypotheses* [Pepper, 1942], Piagetian theory has generally been considered a paradigmatic exemplar of organismic metatheory – emphasizing activity, dialectical change, and organization as foundational features. In contrast, most forms of behaviorism including early Skinnerian theory were historically understood as paradigmatic of a mechanistic metatheory – emphasizing foundational stasis and uniformity. Standing as monolithic representatives of organismic and mechanistic assumptions, it is indeed the case that any rapprochement is impossible. However, over the past few decades, developments within the domain of contemporary behavior-analytic theory have resulted in a distancing from several aspects of the early Skinnerian doctrine and more importantly, from mechanistic metatheory itself [Chiesa, 1992, 1994]. It is this distancing – first taken by those [Hayes, Hayes, & Reese, 1988; Morris, 1988, 1993] who argued that behaviorism's foundations are to be found in a contextualist rather than a mechanistic worldview – that provides an initial opening for a potential integration of cognitive-developmental and behavior-analytic approaches.

To argue that contextualism generates modern behavior-analytic theory is a step towards integration, but only one step, and the reason for this is that traditional interpretations of contextualism maintain that this worldview, while closely related in several ways to an organismic worldview, remains a separate, distinct, and – most importantly – competing alternative [Pepper, 1942]. A more complete move towards integration requires a set of metatheoretical assumptions that will transcend both

contextualism and organicism, and, while maintaining their distinct qualities, unite them.

Such a metatheoretical framework will constitute a base for the rapprochement of cognitive-developmental and behavior-analytic theory *without* fundamentally altering the specific theoretical content or the explanatory style of either approach.

Metatheory – Split and Relational

All concepts and methods are contextualized by some metatheoretical framework [Overton, 2003]. A metatheory provides basic constructs that articulate the meaning of concepts and methods in a domain of inquiry. A metatheoretical frame offers advice, guidelines, and criteria for decisions concerning the nature, and the adequacy or inadequacy of a theoretical and methodological approach to the domain under investigation. A metatheory is prescriptive in the sense that it defines what is meaningful and what is meaningless, what is acceptable and unacceptable, what is central and what is peripheral to inquiry. To grasp how *relational metatheory* offers guidelines and criteria for transforming incompatible theoretical approaches into co-equal indissociable complementarities, it is necessary to understand the metatheory that generates the incompatibilities. This has been referred to as a *split metatheory*. Relational and split metatheories compose the world in different ways; relational metatheory draws the world as systems of dynamic changing part-whole relations, split metatheory draws the world as aggregates of dichotomous elements.

Split Metatheory

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 that are taken to describe basic 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 (the atoms of atomism) – pure forms – that preserve their identity regardless of context. A corollary principle here is the belief that all complexity is *simple complexity* in the sense that any whole is taken to be an *additive* combination of its elements.

Splitting, foundationalism, and atomism are all principles of decomposition; breaking an aggregate down to its smallest pieces, to its bedrock. This process also goes by other names including *reductionism* and the *analytic attitude* [Overton, 2002]. Split metatheory requires another principle to reassemble or recompose the whole. This is the principle of *unidirectional and linear (additive) associative or causal sequences*. The elements must be related either according to their contiguous co-occurrence in space and time, or according to simple efficient cause-effect sequences that proceed in a single direction [Bunge, 1963; Overton & Reese, 1973]. In fact, split metatheory admits no determination other than individual efficient causes or these individual causes operating in a conjunctive plurality (i.e., additive).

That is, no truly reciprocal causality is admitted [Bunge, 1963; Overton & Reese, 1973].

All fundamental incompatibilities or antinomies emerge from a split metatheoretical context. The individual-social or individual-collective or person-social antinomy, for example, represents all behavior and action as the additive product of elementary bedrock pure forms identified as genes and environment. Arising from this splitting, behavior is understood as an aggregate composed of these two pure forms, and the question becomes one of the primacy or privileged quality of one or the other. Nativism-empiricism is a closely related antinomy in which the pure forms consist of, on the one hand, some basic biological form or element (e.g., DNA, genes, neurons) and, on the other hand, some basic environmental element (e.g., parents, society, culture) [see Overton, 2004].

Relational Metatheory

Within a relational metatheoretical context, the fundamental incompatibilities or antinomies dissolve because such dichotomous exclusive pairs come to be treated as truly co-equals, and if they are truly co-equals then there can be no issue of primacy or privilege. But to say that they are co-equals is one thing, and to demonstrate their co-equal status is another. It is the task of relational metatheory to articulate the process through which seemingly contradictory categories can be co-equal and indissociable while maintaining their individual identity (i.e., their complementarity); to demonstrate that the co-equality of categories need not involve an absolute relativism; and to demonstrate that this metatheory is a valid basis for scientific inquiry.

Holism

The basic principle that guides a relational metatheory is *holism* – a core principle, we will see, of both contextualism and organicism. Holism is the assertion that the identities of objects and events derive from the relational context or system 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, 1968a, b], in that the whole or system is not decomposable into elements arranged in additive linear sequences of cause-effect relations [Overton & Reese, 1973]. Nonlinear dynamics are a defining characteristic of this type of complexity. In the context of holism, principles of splitting, foundationalism, and atomism are rejected as meaningless approaches to analysis, and fundamental antinomies such as person-culture are similarly rejected as false dichotomies.

With holism as the superordinate principle, relational metatheory moves to specific principles that define the relations among parts and the relations of parts to wholes. In other words, relational metatheory articulates principles of analysis and synthesis necessary for any scientific inquiry. These are the principles of (a) the identity of opposites, (b) the opposites of identity, and (c) the synthesis of wholes [see Overton, 2003, for an extended discussion].

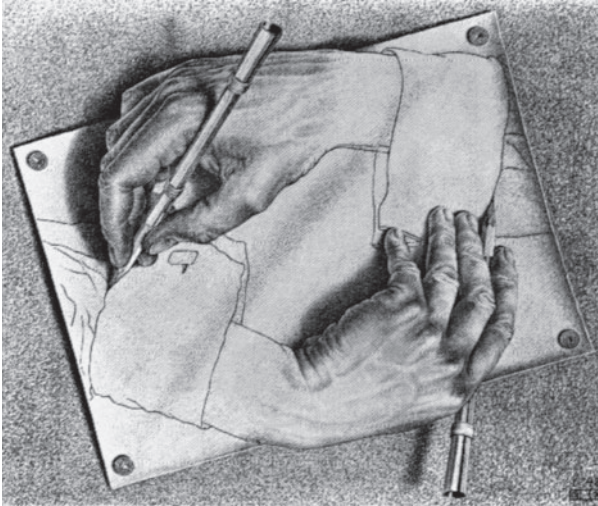


Fig. 1. M.C. Escher's 'Drawing Hands' © 2006 The M.C. Escher Company – Holland. All rights reserved. www.mcescher.com.

The Identity of Opposites

The principle of the *identity of opposites* establishes the identity among fundamental parts by casting them, not as exclusive contradictions as in split metatheory, but as differentiated polarities (i.e., co-equals) of a unified (i.e., indissociable) inclusive matrix, as a relation. As differentiations, each pole is defined recursively; each pole defines and is defined by its opposite. There are a number of ways of articulating this principle but perhaps the clearest articulation is found in considering the famous ink sketch by M.C. Escher titled 'Drawing Hands' (fig. 1). In this sketch, a left and a right hand assume a relational posture according to which each is simultaneously drawing and being drawn by the other. In this relational matrix, each hand is *identical* – thus co-equal and indissociable – with the other in the sense of each drawing and each being drawn. This is a moment of analysis in which the law of contradiction (i.e., not the case that $A = \text{not}A$) is relaxed and identity (i.e., $A = \text{not}A$) reigns. In this *identity moment of analysis*, pure forms collapse and categories flow into each other. Here each category contains and, in fact, *is* its opposite. As a consequence, a broad inclusivity is established among categories. If we think of 'inclusion' and 'exclusion' as different moments that occur when we observe a reversible figure (e.g., a Necker cube or the vase-women illusion), then in this identity moment we observe only inclusion. In the next (opposite) moment of analysis the figures reverse, and there we will again see exclusivity as the hands appear as opposites and complementarities.

Within this identity moment of analysis, it is a useful exercise to write on each hand one of the bipolar terms of a traditionally split antinomy. Cognitive-developmental and behavior-analytic approaches to psychology in general, and development specifically, have been considered antithetical primarily because of the seeming an-

tithesis between the mental events pursued by cognitive development and behavioral events pursued by behavior analysis. However, when this antithesis is cast as the left and right Escherian hand, the exclusivity disappears. The mental and behavioral create and are created by each other; to say that an event is mental in no way denies it is behavioral, to say it is behavioral in no way denies it is mental. This exercise is more than merely an illustration of a familiar bidirectionality of effects suggested by many scientific investigators. From this stance, the two distinct elements do not simply *interact* with one another, but various parts of a whole *interpenetrate* one another. This interpenetration means that any notion of pure forms is conceptually incoherent and, consequently, so too are notions of reductionism, foundationalism, and atomism. This exercise makes tangible the central feature of the relational metatheory; seemingly dichotomous ideas that have been thought of as competing alternatives can, in fact, enter into inquiry as co-equal indissociable supportive partners. It also concretizes the meaning of any truly nonadditive reciprocal determination [Overton & Reese, 1973].

The assertion of nonadditivity also illustrates the fact that this metatheoretical principle, like any metatheoretical principle, introduces constraints on inquiry. If the mental and the behavioral are related in a nonadditive fashion, then so, too, are the biological and environmental, and it no longer makes sense to consider any outcome measure (e.g., intelligence, concepts, language, traits, styles) as being decomposable into the independent and additive pure forms of biology and environment. Thus, from the perspective of relational metatheory, the principles of social constructivist or strict behavioral approaches that elevate the environment – particularly the cultural environment – to a privileged primary position, or biological reductionists who elevate biology – particularly the brain – to a privileged primary position lead to seriously incomplete approaches to inquiry.

If the principle of the identity of opposites introduces constraints, it also opens possibilities. The most important possibility is the recognition that, to paraphrase the philosopher John Searle [1992], the fact that a behavior is determined by biology or determined by some mental organization does not imply that it is not socially or culturally determined, and the fact that it is socially or culturally determined does not imply that it is not determined by biological or mental events. In other words, the identity of opposites establishes the metatheoretical position that genes and culture, like culture and the mental, and the brain and the mental, operate in a truly *interpenetrating* manner, and further that any concept of *interaction* (e.g., interaction, co-action, transaction) must be interpreted not as the cooperation or competition among elements, but as the *interpenetration* among parts. With this recognition, any debate based on antinomies, whether it be mind-behavior, nativism-empiricism, person-culture or any other, ceases to have merit. That is, given the denial of pure forms implied by the identity of opposites, questions of development cannot be cast as having a nativistic or empiricist, or personal or environmental origin. The environment cannot be claimed to have primacy over the individual in any sense, just as the individual cannot be claimed to have primacy over the environment in any sense. Within developmental psychology, when the individual and environment are understood as interpenetrating parts of a whole, neither of which has causal primacy over the other, the focus is shifted to the arguably more complex understanding of active, dynamic, nonlinear systems, rather than to arguments over the linear causes of development.

The Opposites of Identity

Although the identity of opposites sets constraints and opens possibilities in that it establishes the co-equal and indissociable character of basic polarities, it does not, in itself, establish the complementary nature of these polarities. Establishing the identities as complementarities within relational metatheory requires moving to a second moment of inquiry. In this second moment, the identity of categories that flow into each other fades into the background, figure and ground are reversed, and the moment becomes dominated by exclusivity and the opposite features of the polarity. Thus, in this opposite moment of analysis, identity notwithstanding, Escher's sketch shows a *right* hand and a *left* hand, and these are opposites. In this moment, the law of contradiction (i.e., not the case that $A = \text{not}A$) is asserted and categories again exclude each other and become opposites. As a consequence of this exclusion, parts exhibit unique identities that differentiate each from the other as complementarities.

A second important feature of the opposites of identity is that this moment rescues relational metatheory, and theories constructed within a relational metatheoretical context, from accusations of introducing an absolute relativism into the world of science [see Overton, 2002, for an extended discussion]. Split metatheories generate absolutist positions. Empiricism generated the idea of attaining an absolute bedrock certainty through the reduction of all ideas and events to the foundational material world. Postmodern social constructivist [e.g., Gergen, 2001] and some sociocultural positions – while paying lip service to the denial of both the foundationalism of empiricism and foundations generally – take an implicit foundationalist position through the claim of privilege and primacy for the sociocultural world. Because the social is contingent, this foundationalism leads to an absolute relativism, as found, for example, in discussions of cultural relativism [see Latour, 1993]. In the moment of identity, relational metatheory also establishes a relativism, as categories flow into each other. However, this relativism is not absolute because, in the moment of opposition, category boundaries are reestablished and categories again exclude each other (e.g., left hand is a left hand, not a right, and right hand is right, not left; the person is not culture, and culture is not the person). At this moment, each term of a bipolarity is no longer relative to its complement; it has its own individual identity and its own features. This position becomes what Latour [1993] has termed a 'relative relativism.' It is a relativism that allows inquiry to proceed within a stable framework; stability is discovered in instability.

These stable frameworks act as platforms for launching scientific inquiry. These platforms are generally termed 'standpoints,' 'points of view,' or 'lines of sight,' in recognition that they do not reflect absolute foundations [Harding, 1986]. Again consider Escher's sketch as illustrative: when the left hand as left hand, or the right as right hand, is the focus of attention, then – were they large enough – one could stand on either hand and examine the structures and functions of that hand. Thus, while recognizing that everything is, at one and the same time, biological, psychological, and environmental, alternative points of view permit the scientist to analyze any act or behavior from *the standpoint of the psychological person* (i.e., the mental organization of the cognitive-developmental), from a *biological standpoint*, or from an *environmental standpoint* (i.e., the setting conditions and environmental contingencies of the behavior-analytic). From this stance, cognitive-developmental and

behavior-analytic theories need no longer constitute ontologically competing alternative explanations; rather, they can be understood as two points of view on an object of inquiry that has been both created by, and will only be fully understood through multiple viewpoints. To state this more generally, the unity that constitutes human identity and human development becomes discovered only in the diversity of multiple interrelated lines of sight.

Before proceeding to the fourth principle of a relational metatheory, consider, as illustrative of the last two principles, the notion of 'behavior.' Any given behavior can serve *either* an expressive *or* an instrumental function. If understood as expressive, then the behavior is the expression of some underlying system (e.g., system of consciousness, meaning system, emotional system) and this system becomes the focus of inquiry. If that same behavior is understood as serving an instrumental or *operant* function, then it entails the achievement of some outcome (e.g., obtaining social attention, escape from a particular situation), and this achievement becomes the focus of inquiry. In a classic split metatheoretical framework, the expressive and instrumental are presented as competing alternatives – more specifically an issue of structure versus function – and in such a world of 'nothing but', the preferred perspective is elevated to a foundational status. Herein, for example, lies the basis of the infamous Chomsky – the expressivist/Skinner – the instrumentalist language debate.

The Synthesis of Wholes

Engaging fundamental bipolar concepts as relatively stable standpoints opens the way, and takes an important first step, toward establishing a broad stable base for empirical inquiry within a relational metatheory. However, this solution is incomplete because it omits a key relational component, the relation of parts to the whole. The oppositional quality of the bipolar pairs reminds us that their contradictory nature still remains, and continues to require a resolution. Further, the resolution of this tension cannot be found in the split approach of reduction to a bedrock reality. Rather, the relational approach to a resolution is to move away from the extremes to the center and above the conflict, and to here discover a novel system that will coordinate the two oppositional systems. This is the principle of the synthesis of wholes, and this synthesis itself will constitute another standpoint.

At this point, the Escher sketch fails as a graphic representation. While 'Drawing Hands' illustrates the identities and the opposites, and while it shows a middle space between the two, it does not present a coordination. In fact, the synthesis for this sketch would be an unseen hand that is drawing and being drawn by the drawing hands. The synthesis of interest for the general metatheory would be a system that is a coordination of the most universal bipolarity that can be imagined. While there may be several candidates for this level of generality, the polarity between *matter or nature* and *society* seems sufficient for present purposes [Latour, 1993]. Matter and society represent systems that stand in an identity of opposites. To say that an object is a social object in no way denies that it is matter, to say that an object is matter in no way denies that it is social. And further, the object can be analyzed from either a social or a physical standpoint. The question for synthesis becomes the question of what system will coordinate these two systems. Arguably the answer is that it is *life* or living systems that coordinate matter and society. Because

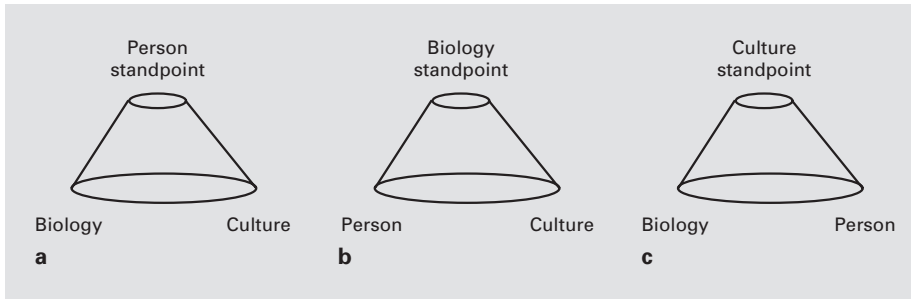


Fig. 2. Relational standpoints in psychological inquiry: person (a), biology (b), and culture (c).

our specific focus of inquiry is the psychological, we can reframe this matter-society polarity as the polarity of *biology* and *culture*. In the context of psychology then, as an illustration, write ‘biology’ on one and ‘culture’ on the other Escher hand, and consider what system coordinates these systems. It is the human organism, the *person* (fig. 2a). Person – as an integrated self-organizing dynamic system of cognitive, emotional, and motivational processes and the behaviors this system expresses – represents a novel level or stage of structure and functioning that emerges from, and constitutes a coordination of, biology and culture [see Magnusson & Stattin, 1998].

At the synthesis then, there is a standpoint that coordinates and resolves the tension between the other two members of the relation. This provides a particularly broad and stable base for launching empirical inquiry. A *person standpoint* opens the way for the empirical investigation of universal dimensions of psychological structure-function relations, their individual differences, and their development across the lifespan (e.g., processes of perception, thoughts, emotions, values). Because universal and particular are themselves relational concepts, no question can arise here about whether the focus on universal processes excludes the particular; it clearly does not as we already know from the earlier discussion of polarities. The fact that a process is viewed from a universal standpoint in no way suggests that it is not contextualized.

It is important to emphasize here that one standpoint of synthesis is *relative* to other synthesis standpoints; no standpoint is thus privileged over any other. Life and society are coordinated by matter, and thus, within psychological inquiry, *biology* represents a *standpoint* as the synthesis of *person* and *environment* (fig. 2b). The implication of this is that a relational biological approach to psychological processes investigates the biological conditions and settings of psychological structure-function relations and the behaviors they involve. This exploration is quite different from split foundationalist approaches to biological inquiry that assume an atomistic and reductionistic stance towards the object of study.

A third synthesis standpoint recognizes that life and matter are coordinated by society or even more broadly, by the *environment*. Again, granting that the inquiry is about psychological process, *environment* represents a standpoint as the synthesis of *person* and *biology* (fig. 2c). Thus, a relational environmental standpoint explores

cultural and environmental determinants of action and behavior that are themselves understood to be equally determined by the person and biology. Although there are illustrations of all three standpoints as they impact our understanding of human action, behavior, and development, given the nature of this paper, we will from here forward limit ourselves to the person standpoint represented by cognitive-developmental theory and the environmental standpoint represented by behavior-analytic theory [see Overton, 2004, for examples of the biological standpoint]. Broadly, the argument is that to make a claim that a particular action or behavior is determined by a mental event such as a concept, representation, or scheme is complementary to the claim that the same action or behavior is determined by environmental contingencies. This metatheoretical complementarity begins to address and transcend the various dichotomies that arise in cognitive-developmental and behavior-analytic theories [see Midgley & Morris, 1992].

Cognitive-Developmental and Behavior-Analytic Theories Operating within Relational Metatheory

With the four principles of relational metatheory as our background, we may now begin to more closely examine potential avenues of rapprochement between cognitive-developmental and behavior-analytic theories. Our first step will be to describe how taking a relationalist approach permits a synthesis of the traditionally contextualist assumptions of behavior-analytic theory and traditionally organismic assumptions of cognitive-developmental theory. Stephen Pepper [1942] in his seminal work *World Hypotheses* specifically recognized the closeness of contextualism and organismism. As he said:

actually, the historic event which is the root metaphor of contextualism is a nearer approximation to the refined root metaphor of organismism than any commonsense term. This is so true that it is tempting to regard these two theories as species of the same theory, one being dispersive and the other integrative. (p. 280)

Despite this closeness, Pepper [1942] ultimately argued that these dispersive and integrative features of the two types constituted ‘a flat categorical contradiction’ (p. 281). If, however, we look at this contradiction within relational metatheory, the contradiction itself disappears, being replaced by a complementarity. That is, when ‘dispersive’ and ‘integrative’ are examined as an *identity of opposites*, it becomes clear that, on the one hand, dispersion (differentiation) is the origin of integration (coordination) and, on the other hand, integration is the origin of dispersion. This point must be recognized as the key to the whole argument presented in this essay. When the dispersive and integrative are explored as an *opposites of identity*, the integrative (i.e., the organic cognitive-developmental with its focus on the psychological subject and mental structures that define this subject) and the dispersive (i.e., the contextualistic behavior-analytic with its focus on behavior-environment functional relations) represent two complementary indissociable points of view, not competing alternatives. Further, if integration and dispersion are two sides of the same coin, then various related concepts may have both a dispersive and an integrative identity, and these concepts, too, will be complements, not competing alternatives.

Two of these related concepts are the core concepts of holism and the dialectic. Contextualist behavior-analytic and organismic cognitive-developmental theories each present 'holism' and 'dialectic' as central tenets of their systems. However, in each system, holism and dialectic have quite different meanings. This is because contextualism gives a dispersive or differentiated meaning to these concepts and organismism gives the same concepts an integrative meaning. In the next section, we examine the complementarity of these meanings.

Shared Assumptions

Holism

As described earlier, holism broadly refers to the idea of a whole not being 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. Therefore, from a holistic perspective, the identities of objects and events derive from the relational context or system in which they are embedded.

Organismic cognitive-developmental theory takes as its focus of inquiry – its standpoint – the psychological person and within this context, holism references the integrated features of this psychological subject (i.e., holism references mental organization or mental structures). The psychological subject is the 'organic whole' of cognitive-developmental theory, a whole in which every part within it implies and is defined by every other. The embrace of this integrative holism by cognitive-developmental theory by definition rejects the notion that the psychological subject is in any fundamental way reducible to its constituent parts. Removing or altering any part of the whole in turn alters or destroys the system itself.

Behavior-analytic theory, when viewed as operating within a dispersive contextualistic framework, asserts, not the holism of the psychological subject, but the holism of the *behavioral act in context*. This focus – this standpoint – on the immediate event or act results in holism here being defined in terms of the structure of this act including its *quality* (i.e., the act's wholeness) and its *texture* (i.e., its parts). As Pepper [1942] emphasized, quality and texture are not separable, and the whole act is presumed to be greater than the sum of its parts.

Perhaps even more importantly, the holism as presented in contemporary behavior-analytic theory does not limit itself to isolated acts. Acts are only understood as operating in a context, and the quality, texture, and context constitute the integrated features of the holism of behavior-analytic theory [Hayes et al., 1988]. The role of the context (i.e., the environment) in this type of holism is elaborated in Pepper's [1942] statement that 'the quality of an event is the fused quality of its strands, and the qualities of the strands come partly out of its context, and there we are outside of the event' (p. 249). Thus, the role of the environment in contextualistic behavior analysis is not exclusively causal, but rather it operates as an irreducible part of 'the act' (i.e., behavior) as a holistic system. This inseparable interconnectedness of the quality, texture, and context of an act is reflected in the focus on behavior-environment relations as the subject matter of the behavior-analytic, compared to the focus on the integrated psychological organism in cognitive-developmental theory.

The two forms of holism, thus, constitute an identity of opposites in their dispersive-integrative modes, and it is the opposites of this identity that yield the distinct meanings found in cognitive-developmental and behavior-analytic treatments. The holism of the one focuses on the system itself, where integration is central, while the holism of the other focuses on the acts, and here dispersion and variation are central.

The Dialectic

The second fundamental principle that relationally joins cognitive-developmental and behavior-analytic theories is the dialectic. Each theoretical stance asserts the centrality of this process, and each begins with the basic identification of the dialectic as a process entailing the working through of contradictions (i.e., affirmations and their negations). However, as with holism, behavior analysis defines the dialectic from its dispersive standpoint, while cognitive-developmental theory defines it from its own integrative standpoint.

The dispersive dialectic of behavior-analytic theory operates on the level of acts. Contradictions (i.e., affirmations and their negations) operate within and between classes of acts as well as in relation to the context. Across time, the tensions between the affirmations and negations are resolved as novel acts that emerge and replace the older contradictory acts in that particular context [Reese, 1993]. For example, in behavior-analytic theory, the process of reinforcement represents the affirmation of an act and the process of extinction represents the negated resistance that a previously reinforced act meets. It is from the interplay of reinforcement and extinction that *novel action emerges* to replace extinguished acts in the current behavioral repertoire.

The integrative dialectic of cognitive-developmental theory operates at the level of the psychological subject or mental organization. Any act is an affirmative expression of this organization and every affirmative expression ultimately meets a resistance, which constitutes a negation. In the interplay of affirmations and negations, a *novel system emerges* that coordinates, or integrates, the original contradictions. For example, in Piagetian theory, assimilation represents the affirmative dimension of an act and accommodation the negated resistance that assimilation meets. It is from the interplay of assimilation and accommodation that the psychological system moves from lower to higher levels of functioning.

Thus, as with holism, the two forms of dialectic process constitute a dispersive-integrative identity of opposites, and the opposites of this identity yield the distinct meanings found in cognitive-developmental and behavior-analytic treatments.

The relational dispersive-integrative identity of contextualism and organicism along with the holistic and dialectic complementarities that flow from this identity constitute the fundamental relational ground for the joining of behavior-analytic and cognitive-developmental theoretical perspectives. Proceeding from this relational ground, we will now explore its impact on an understanding that is essential for both theories – the issue of the nature of scientific explanation.

Scientific Explanation

The question of what will be and what will not be accepted as a scientific explanation is critical to any scientific effort because it forms the primary demarcation between the scientific and the pseudoscientific. In psychology, alternative answers to

the question of what constitutes a scientific explanation have long operated as a fundamental wedge dividing theoretical approaches [Overton, 1991]. The history of this issue stretches back to Aristotle, who proposed that a complete scientific explanation must entail four causes, specifically, four forms of explanation that entail the conditions under which we commonly speak of causation. These include: (a) material cause (that of which the thing is made), (b) efficient cause (that which moves the thing), (c) formal cause (the form of the thing), and (d) final cause (that which the thing is directed toward, or the larger relation the thing is part of). With the rise of the Newtonian mechanistic worldview, the efficient and material cause – taken to be directly observable – came to reign absolutely within science, while pattern explanation (formal and final cause) was rejected on the basis of its inferential status. The privileging of the efficient and material cause in the methodology of neopositivism carried over into 20th century psychology in early forms of behaviorism, and even in mechanistic forms of cognitive psychology where the stimulus-response (S-R) or input-output functionalism served as the bedrock of psychological reductionism. However, by the 1960s, philosophers and historians of science including Hanson [1958], Kuhn [1962], Lakatos [1970], Putnam [1992], and Laudan [1977] began a discourse that argued that science necessarily entails an interpretive component. As a result, formal and final pattern explanation re-entered the arena of legitimate scientific explanation [see Overton, 2002].

Within the behavior-analytic community, traditional mechanistic behaviorists armed with the goal of establishing an observationally pristine interpretation-free strict objectivity have been advocates of limiting scientific explanation to efficient causation as illustrated in the S-R formulation [Donahoe, Palmer, & Burgos, 1997; Staddon, 1973]. However, with the rise of contextualistic behavior analysis, pattern explanation, specifically final explanation, has moved to the foreground. There is still argument between the advocates of behavior-analytic theory over the most appropriate characterization of final explanation within the theory. The traditional mechanistic behaviorists continue to argue that all final explanation must ultimately be reduced to efficient cause [Staddon, 1973], while those adhering to a more contextualistic stance argue that pattern must be accepted as explanation in its own right, without reduction to some other level of explanation [Hineline, 2004; Rachlin, 1992, 1994].¹

How then, from a relational metatheoretical perspective, do behavior-analytic and cognitive-developmental theories join regarding the issue of scientific explanation? For those adhering to a mechanistic perspective, there is no rapprochement between cognitive-developmental and behavior-analytic theories. The classical mechanistic position is a ‘nothing but’ position that shuns relational concepts. However, deriving from their dispersive-integrative holistic and dialectic identities, non-mechanistic cognitive-developmental and contextualistic behavior-analytic theories are further joined in their agreement that pattern explanation constitutes a legiti-

¹ Skinner’s own writings reflect the conflict between efficient causal explanation and final pattern explanation in terms of which most accurately describes the type of explanation used within his own system [Moxley, 1999; see Skinner, 1974]. A subsection of his successors have continued the debate [see Dinsmoor, 2001, with commentaries) and have described the issue specifically in terms of Aristotle’s four types of explanation [Rachlin, 1992, 1994].

mate form of scientific explanation. But here again, the dispersive-integrative dimension, while constituting an identity of opposites, offers distinct foci of inquiry and hence distinct meanings for each theoretical perspective. Integrative cognitive-developmental theory requires both formal and final explanation while dispersive behavior-analytic theory requires a more concentrated focus on final explanation. Here we will first consider the issue of formal explanation followed by the issue of final explanation.

Formal Explanation. Behavior analysts have long been critical of the notion of the mental structures described by cognitive-developmental theory, an argument stemming from Skinner's rejection of mentalism [Skinner, 1963] and structuralism [Skinner, 1974]. However, it needs to be recognized that within a cognitive-developmental framework mental structures are not taken to be physical objects or homunculi; they represent the organization of the action system. The structure of the atom, the structure of DNA, the structure of the solar system, and the structure of the universe are all familiar examples of formal explanations drawn from the natural sciences. Kinship structures, mental structures, mental organization, structures of language, ego and superego, dynamisms, schemes, operations, and cognitive structures are familiar examples of formal explanations drawn from the behavioral sciences. The commonality among all these examples is that, given some activity (function), inferences are drawn as to the pattern of this activity (structure), and this pattern constitutes the formal explanation of the phenomena [Overton, 1975]. This is explanatory, not descriptive, in that it presents what are taken to be necessary system conditions for the possibility of the act's occurrence. Structure (or pattern, form, system, or organization – all used interchangeably here) is not directly observable and, in principle, cannot be reduced solely to observables. Pattern is inferred from observables; however, the method of inference is not induction but retroduction.² As a retroductive inference, pattern explanation emerges from the interplay of interpretation and observation.

To properly understand the explanatory significance of formal explanation, two frequently voiced criticisms must be addressed. The first is the criticism that a formal explanation constitutes engaging in nonscientific circular reasoning. For example, an explanation that preschool-aged children have difficulty sitting still and listening to a story *because* they have 'short attention spans' is considered to be a circular explanation as one only knows if a child has a short attention span if they cannot sit still and listen to a story. Thus, in this argument, the inferred entity (i.e., short attention span) used to explain the behavior is said to be merely a summary description of that behavior, not an explanation [Novak, 1996; Novak & Pelaez, 2003]. The weakness of this argument is that it fails to recognize the crucial distinction between *circular* and *viciously circular* reasoning. Virtually every science engages in inferences to unseen explanatory entities and, hence, engages in circular reasoning. However, the circularity of this activity is limited by the additional scientific methodological principle that inferred patterns must predict behaviors that

² The nature of this inference follows the form of the transcendental argument [Dennett, 1987; Russell, 1996; Taylor, 1995].

go well beyond those that constitute the source of the initial inference. To predict only the inferred behavior constitutes vicious circularity, to predict a set of novel behaviors constitutes genuine scientific explanation. One might wonder whether this approach is descriptive rather than explanatory as the inferred pattern describes the behavior. The answer is that if there were a different inferred pattern for each behavior, it would be descriptive. The explanatory power in the formal explanatory sense comes from establishing a small set of rules that account for a wide range of behaviors [Liben, 1987]. For example, based on observations of an age difference in the ability to maintain an invariant concept concerning the amount of fluid in the face of perceptual changes (i.e., conservation of quantity), Piaget inferred mental 'grouping.' This grouping was then employed to predict successful conservation of quantity, but also conservation of weight, area, or volume. A very similar explanation is used to address critics that claim that the principle of reinforcement from behavior-analytic theory is a circular concept. If the principle of reinforcement were limited to the behavior from which it was originally inferred, it would be viciously circular and have little explanatory power. However, the principle can account for a wide variety of behavior across topographies, individuals, and even species. Cognitive-developmental and behavior-analytic theorists both frequently encounter the criticism of circular reasoning due to the fact that both theories make use of pattern explanation. But again, it must be emphasized that in contemporary scientific explanation, only vicious circularity violates the norms of valid scientific methodology.

The second criticism raised against pattern explanations, specifically formal explanations such as structure, organization, form, and the like, is that such patterns are static in nature and therefore inadequate to capture the activity, and change that is characteristic of humans and human development. This is a misplaced criticism that confounds the relation between that which is to be explained and that which does the explaining. Pattern explanation does the explaining (i.e., presents the necessary conditions), and patterns of activity and patterns of change are what are to be explained. Constancy is introduced through the inference of pattern, but it is the constancy of explanation and not a constancy of 'that-which-is-to-be-explained.' If, as virtually everyone agrees, empirical science is about 'organized' empirical knowledge, or about 'patterns' of relations, then invariance must be established in some realm. For the behavior analyst, coming from an environmental perspective and focusing on the behavioral act, invariance will be found in the existential patterned arrangement of behavior-environment relations observed in the natural world. For the cognitive-developmental theorist coming from a person-centered position and focusing on the person as a system, invariance will be found in the patterns inferred from the actions themselves. The unification of these two positions that arises from embracing the relational identity of opposites leads to a true integration of the knower and the known and an end to the person-environment antimony.

Cognitive-developmental theory, because of its focus on the person as a system of activity that transforms itself through its actions, has long advocated the centrality of both formal and final explanation. Cognitive-developmental theory introduces formal explanation in the understanding of immediate states of the cognitive-affective-conative person. It introduces final explanation in understanding the development of this active, transformational system.

We will return to final explanation and its importance; but to further clarify the exact status of formal explanation in cognitive-developmental theory, a brief digression into structure-function relations is necessary. Function has alternative meanings that derive from relational and from split frames of reference. Within the relational framework, structure and function represent a complementarity. Function here is the natural, proper, or characteristic action of some object or event [Random House Webster's Unabridged Dictionary, 2001]. Thus, within this relational meaning, a reciprocal relation exists between the object (i.e., the structure) and its function, and except for the purposes of analysis, *the two cannot be separated*. Here we have the meaning that operates in cognitive-developmental theory with its commitment to an interrelation between necessary organization (structure) and activity (function). The fact that in any given analysis the functional or the structural side of the equation is relatively more elaborated is quite irrelevant.

A second, split meaning of function elevates action to a privileged position by denying or marginalizing the system that is the source of the act. Here a functional analysis is one in which function is divorced or split off from structure. The *functional* analysis of behavior as described by behavior analysts has often appeared to assume this split stance. The source of the act (i.e., the organized system) is marginalized or disparaged, and the act in relation to its consequences is privileged. Operating within a split metatheory, this position maintains a kind of splendid isolation, but it is an isolation that may ultimately prove detrimental to the theory itself. Moving toward a relational metatheory in which structure and function operate reciprocally does not shift the *emphasis* away from functional behavior-consequence relations in behavior-analytic theory, but rather opens several doors for increasing the scope of the theory as well as providing the base for productive interdisciplinary discourse.

While the forgoing discussion has focused on the *structure* of the psychological organism and the *function* of the act, it is also possible to examine the reciprocity of structure and function at the level of the act itself, which may be particularly valuable to a relational behavior-analytic theory. Behavior analysts have long struggled with the role that the *organization* of past behavior-environment interactions plays in the production of the present act. The issue is usually handled through appealing to the generally amorphous 'history of reinforcement' or 'behavioral repertoire.' However, it is becoming increasingly clear that these past behavior-environment interactions are not a simple or trivial determinant of current action. This issue is recognized by some in the behavior-analytic field, for example:

... some behavior analysts hold the opinion that the behavior-analytic perspective is inconsistent with the notion that prior history can continue to exert influence in the present ... Although these viewpoints may be philosophically appealing to some behavior analysts, it is difficult to justify this perspective in light of the potent, lasting effects that behavioral history can play in determining current behavior. [Tatham & Wanchisen, 1998, pp. 242-243]

A structural analysis of the behavioral repertoire in terms of formal explanation would operate in an analogous fashion to the analysis of mental structures in cognitive-developmental theory. Understanding the organization of the behavioral repertoire is extremely important for the analysis of cognition and language, even when

the analysis emphasizes function. This approach follows naturally from the assumption of holism upheld in contextualistic behavior analysis, and its relative absence in the behavior-analytic literature is most likely a result of the discipline's tumultuous historical relations with the mechanistic worldview.

The relational understanding that emerges from the assumption that the organization of the behavioral repertoire changes in a nonlinear fashion through interaction with the world both emphasizes a holistic stance in terms of a structural analysis, and also results in a theory that is inherently developmental in nature. As Morris [1998] has pointed out in describing the nonadditive, nonlinear nature of the contextualistic behavior-analytic view, 'when one functional relation changes ... the *organization* of the response repertoire and its controlling variables will be altered as a whole' (p. 104, italics added). This assertion is not only a result of the a priori assumptions of contextualism, but also of empirical findings for which a linear mechanistic behavior analysis cannot account. For example, the behavior-analytic literature investigating stimulus equivalence [e.g., Sidman, 1994] and relational responding [e.g., Hayes, Barnes-Holmes, & Roche, 2001] address issues of *emergent* relations (i.e., from a behavior-analytic view, 'not directly trained/reinforced') that have proven difficult to explain from a mechanistic view that neglects formal explanation and the role that the organization of the system plays in development.³

The inclusion of formal explanation, and thus further rapprochement with cognitive-developmental theory, has practical utility along with philosophical implications from a behavior-analytic perspective. Within the applied behavior-analytic community, curriculum design for individuals with developmental disabilities has been found to be particularly effective when specific behavior-environment interactions are arranged to occur in a particular sequence [Leaf & McEachin, 1999]. Consequently, the use of theoretically informed curriculum design is becoming more and more important within the behavior-analytic community. However, while those particular sequences of behavior-environment interaction may reflect those described in the cognitive-developmental literature, the historical antipathy between the advocates of both cognitive-developmental and behavior-analytic theories has resulted in the neglect of further explorations of this important parallel.

In summary, when *structure* and *function* are conceptualized as terms that stand in a dialectical relation, thus forming a co-equal and indissociable complementarity, then the structural or formal pattern explanation of cognitive-developmental theory comes to stand as a co-equal indissociable scientific partner with functional explanation of behavior-analytic theory. A similar relation holds with respect to final pattern explanation, to which we will turn in the next section.

Final Explanation. While formal explanations establish order, constancy, and coherence of activity at any point in time (i.e., the form of the thing), final pattern explanations establish order, constancy, and coherence extended in time (i.e., that

³ The relational frame theory attempts to explain such nonlinear change as that described here in regard to human development, particularly in the arena of human language and cognition [Hayes et al., 2001]. While a detailed critique of the theory is too large a digression for this forum, we agree that the 'poverty of the stimulus' argument is overcome by a contextualistic behavior-analytic account similar to that proposed by the relational frame theory.

which the thing is directed towards). Put simply, formal explanations are explanations of what develops, final explanations are explanations of why development occurs. Final explanation represents the organization of the series just as formal explanation represents the organization of any point in the series.

Although behavior analysis has traditionally marginalized formal explanation, advocates of the theory have made great advances over the past decade and a half in understanding the tenets of their system in terms of final explanation [Hineline, 2004; Rachlin, 1994]. This feature of contemporary behavior-analytic theory is perhaps its closest tie to cognitive-developmental theory in terms of shared assumptions about the nature of scientific explanation. Nonetheless, cognitive-developmental and behavior-analytic theories each have distinct yet complementary views of final explanation, and these distinct views, as is the case with other differences, can be traced back to the complementarity of integrative and dispersive worldviews.

Within the field of psychology, final explanation is generally invoked at two levels of analysis. The first is on a relatively local level and involves the directionality of intentional action. Both cognitive-developmental and behavior-analytic theories address this issue in a similar but complementary manner. Arguably this issue of the direction of intentional action has been central to behavior-analytic theory since the time of Skinner's introduction of the concept of the *operant* and central to cognitive-developmental theory since Piaget's introduction of the concept of *assimilation*. That is, the operant is defined as an act in relation to the environmental consequences it produces; assimilation is defined as an act that projects meaning onto the world. Both concepts entail the directionality that is characteristic of final explanation, the operant pointing to the environment that selects the act and assimilation pointing to the system that produces the act.

The second level of final explanation involves accounting for directionality of the sequences that constitutes development. At this level, cognitive-developmental theories have introduced several broad principles including Heinz Werner's orthogenetic principle [Werner, 1957], Erik Erikson's [1959] epigenetic principle, and Piaget's [1967] equilibration principle. In each case, the final explanatory principle accounts for directional changes in the structures of the functioning system. This level of final explanation again focuses on the system and the way in which the system follows an integrative dialectical path of becoming increasingly differentiated and reintegrated. Obviously, this focus belongs to the cognitive-developmental point of view with its integrative system perspective. Just as obviously, the complementary behavior-analytic point of view with its dispersive perspective on acts themselves would have less emphasis on this level of explanation [Gewirtz & Pelaez-Nogueras, 1992, 1996].

In summary up to this point, we have sought to establish that under a relational metatheoretical framework, cognitive-developmental and behavior-analytic viewpoints are reasonably viewed as related and complementary perspectives at several levels. From the broadest level of worldviews, the two theories are complementary in their integrative and dispersive stances. Within these worldviews, the theories are further related on the basis of several fundamental concepts including complementary forms of holism and the complementary nature of the dialectic. Finally, the theories incorporate similar forms of scientific explanation, specifically that involving pattern explanation, a form marginalized in classical mechanistic split approaches.

Having established these complementarities, we now turn to a more specific level of theoretical analysis. At this level, we explore how from a relational metatheory cognitive-developmental and behavior-analytic theories exhibit complementarities in their understanding and application of the concepts of action and change.

Action Theories

Under a relational metatheory, both cognitive-developmental and behavior-analytic theories can, with justification, be described as *action theories*. An action theory is any theory of human development and behavior change that offers action in the world as the principle mechanism of functioning and development [see Mueller & Overton, 1998]. Action theories take seriously the intentional quality of the act and make no principled distinction between whether the act in question is symbolic or subsymbolic. Action theories are distinguishable from other theories of human development and behavior change such as, for example, contemporary cognitivist approaches that describe a computational representational theory of mind, offering representations, encoding, storage, and retrieval devices as basic mechanism of change.

As an integrative action theory, cognitive-developmental theory focuses on the manner in which acts emerge from an organized system of activity, confront the environment, and feedback to transform the adaptive integrated system. As a dispersive action theory, behavior-analytic theory explores how acts specifically change the environment and are, in turn, changed by this interaction.

Classically, there has been disagreement as to whether the organized system (i.e., the person) should be understood as the source of acts (i.e., cognitive developmental theory) or as the locus of the act-environment interaction (i.e., behavior-analytic theory) [Hineline, 1990, 1992]. But here again, the conflict is illusory. Only a dichotomous perspective entails the necessity of claiming that it must be one or the other. A relational position on the issue of agency does not split person from environment and raise one to causal primacy, but instead takes a more holistic stance. As Oyama [2000] has stated, ‘system implies some degree of self-organization, in which “self” is not some privileged constituent or prime mover, but rather an entity-and-its-world ...’ (p. 119). The either-or position that results from asserting that the person is merely the locus of action *or* that the person is the primary source of action entails falling back on split metatheory.

To understand the cognitive-developmental and behavior-analytic perspectives as exemplars of action theories, it is necessary to first highlight the traditional definition of the term *act* or *action* as distinct from *movement*, or more commonly *behavior*. A movement is often defined as a set of muscular contractions that results in displacement of the body in space, while an act is a coordinated pattern of movement that leads to a definable result [Guthrie, 1952; Lee, 1988, 1992]. The outcome-based definition of action has a long history of describing action as *intentional* when compared to movements. Furthermore, this distinction has commonly led to an understood equivalence between the terms ‘movement’ and ‘behavior,’ behavior often being viewed as merely involving movement and states [von Wright, 1971]. While this definition of behavior was common to several types of early behaviorism, the use of the term ‘behavior’ to simply describe movements is *not* the accurate usage of

the term in the contemporary behavior-analytic system. Skinner's concept of the operant specifically defines behavior in terms of its consequences or outcomes, regardless of the movement or 'topography' of a particular act. Some behavior analysts use the terms *movement* and *act* distinctly rather than the more general term *behavior* to emphasize that behavior-analytic theorists are particularly interested in acts and recognize the distinction that the term 'behavior' often obscures [Lee, 1988, 1992]. Thus, the behavior-analytic system distinguishes behavior from movement just as the cognitive-developmental system distinguishes action from movement, the invariance of the two definitions residing in outcome- or goal-related defining features of action and behavior.

Experience

Action-based theories assert that *experience* rather than some split off biological (e.g., genetic blueprints, innate modules) or environmental (e.g., a series of S-R units, culture) determinism constitutes the general mechanism of all behavioral change. However, as with other basic theoretical concepts, experience has complementary cognitive-developmental and behavior-analytic meanings. For both theories, experience is identified as the interaction of the act and the environment, but each has a distinct focus with respect to the nature of this interaction. For cognitive-developmental theory, this identification emphasizes the act itself while behavior-analytic theory emphasizes the environmental consequence of the act. In an older split terminology [see Wohlwill, 1973], one might say that cognitive-developmental theory identifies experience with the response (i.e. intentional action) while behavior-analytic theory identifies it with the stimulus world (i.e., environmental contingencies). From the cognitive-developmental perspective, experience refers to acts of exploring, manipulating, and observing the environment as these acts emerge from an organized system. From a behavior-analytic perspective, experience refers to the environmental relations that constitute this exploring, manipulating, and observing. Thus, it is not surprising that in any detailed analysis of the mechanisms of change cognitive-developmental theory examines action in relation to the person (i.e., organized system) who is the source of these acts, while behavior-analytic theory examines the environmental contingencies as they are determinants of these acts.

From a cognitive-developmental perspective, an act has both *expressive and instrumental functions*. A particular act can be viewed as an *expression* of the current status of the system or the *characteristic* functioning of a dynamic self-organizing system. On this account, the act is the expression of a scheme, an act of assimilation. Acts are said to be *intentional* or goal-directed, which implies a focus on the transformation of the intended object of action. For example, when the infant chews (action) – something that from an environmental standpoint is called a 'basket' – from a cognitive-developmental standpoint, the infant is transforming this part of her actual known world into a practical action 'chewable.' Piaget [1977] repeatedly makes the point: 'To know an object ... is to act on it so as to transform it' (p. 30).

A particular act can also be viewed as serving an instrumental or adaptive function. When looked at from this perspective, the act also results in an important environmental consequence. For example, when a child grasps an edible object and

places it in her mouth, the act is *expressive* in the sense of reflecting a level of cognitive organization, but *adaptive* in the sense serving an important survival function and acquiring a nourishing substance.

The instrumental function of behavior is the bridge that joins cognitive-developmental and behavior-analytic theory as action theories. From a behavior-analytic point of view, an act is determined by its past consequences (i.e., its outcome), and the behavior in relation to its environmental consequences is the primary focus of inquiry. In regard to the *intentional* or *goal-directed* essence of the instrumental function of behavior, Skinner [1974] has made the point: 'possibly no charge is more often leveled against behaviorism ... than it cannot deal with purpose or intention. A stimulus-response formula has no answer, but operant behavior is the very field of purpose and intention' (p. 61).

Assimilation and the Shared Rejection of Association

If an act is both expressive and instrumental, an act also both transforms the environment and is transformed by the environment. This transforming-transformed relation operates at the base of Piagetian theory. Assimilation, as suggested earlier, is the phase of any act that projects (i.e., expresses) the organization of the subject into the world and hence, from the person-centered perspective, transforms the world. Accommodation is the phase of any act that, having been projected, feeds back to change the organization of the subject.

Assimilation functions in cognitive developmental theory as a replacement for the notion of association, a concept that long served as the primary explanatory principle in classical S-R paradigms. As Piaget [1964] stated:

... the fundamental relation involved in all development and all learning is not the relation of association. In the stimulus-response schema, the relation between the response and the stimulus is understood to be one of association. In contrast to this, I think the fundamental relation is one of assimilation. (p. 18)

Here Piaget rejects the idea that association, as postulated by S-R learning theorists, is the fundamental relation in development and learning. Cognitive-developmental theorists argue that assimilation (i.e., the action of the person in the world) is a basic process in the explanation of all learning and development.

Contemporary behavior-analytic understanding agrees with Piaget's assertion in that it, too, denies that the S-R formulation or more importantly association is fundamental. The stimulus-response formulation was problematic for Skinner [1938, 1978] and as a result he reformulated the concept, reassigning it to a purely epistemological status. Furthermore, the concept and importance of association is rejected altogether within the contemporary behavior-analytic system and replaced by the behavior-consequence relation [Glenn, Ellis, & Greenspoon, 1992]. The behavior-consequence contingency is a relation that, while remaining silent in regard to the psychological organization of the person, does indeed emphasize *activity* (i.e., 'behavior' in the behavior-consequence relation) as central in producing environmental change (i.e., the 'consequence') which in turn feeds back to produce a change in that activity.

The behavior-consequence relation is necessarily reciprocal, and as a result the behavior-analytic community has distinguished this relation as ‘closed-loop’ in contrast to the unidirectional relation emphasized in the S-R formulation referred to as an ‘open-loop’ relation [Hineline, 1986]. Regarding this bidirectionality of these relations, Piaget’s objections to the S-R formulation in favor of assimilation are strikingly similar to those provided by behavior analysts in their rejection of primacy of the S-R relation. Piaget [1964] has remarked:

... when you think of a stimulus-response schema, you think usually that first of all there is a stimulus and then a response set off by this stimulus. For my part, I am convinced that the response was there first ... In other words, I would propose that the stimulus-response schema be written in the circular form. (p. 15)

In this particular critique of the S-R formulation, in order for the response to be there before the stimulus becomes significant through the process of assimilation, there must be an organization or ‘structure’ that produces the response. Piaget goes on to add ‘of course we would want to understand how this structure comes to be’ [Piaget, 1964, p. 15]. It is at this point that the behavior-analytic and cognitive-developmental systems diverge into distinct lines of sight. With its focus on action-environment relations, behavior analysis de-emphasizes structure by assuming that activity precedes environmental events (i.e., ‘the response was there first’), but this activity is assumed within the system as a primitive without questioning the organization of that activity, or how that activity came to be. To clarify:

Skinner ... did not concern himself with why behavior varies, only with how patterns of behavior are drawn out from the variations that already exist. In looking at functional relationships between acts and their effects on the world, Skinner broke with the S-R, input-output model. [Vargas, 1990, p. 9]

The issue of whether or not psychological theory should address the nature of this variability becomes problematic much in the same manner that it has proven problematic for Darwinian theory. By remaining silent on the nature of the variation upon which environmental selection acts, this variation would appear to be *random* as opposed to *organized*. Due to the concern of environment-based selectionist accounts including Darwinian and Skinnerian theories (albeit on vastly different time scales), with *how* patterns are selected from inherent variation via environmental conditions, they need not necessarily address the nature of this inherent variation. However, the assumption of *random* variation ultimately leads to a *split-off* selectionistic theory that cannot be reconciled or integrated with those theories operating from a system-based relational metatheoretical grounding [Overton, 1998].

Change and Development

As stated, all action theories agree that experience (i.e., action in the world) constitutes the general process of all behavioral change. This process needs further specification from both the cognitive-developmental and behavior-analytic viewpoints.

First, a distinction is often made between development and learning. In this dichotomous understanding, development is presented as a spontaneous, nonenvironmentally determined unfolding of the genetic blueprint. Learning, in contrast, is presented as entirely determined by the environment. This dichotomy has long been one of the major justifications for dismissing behavior-analytic theory as a legitimate approach to the study of human development [Gewirtz & Peleaz-Nogeuras, 1996]. However, from the view of a relational action theory, this dichotomy represents yet another unnecessary antimony.

Any behavioral act arises from a dynamic organized system (i.e., the psychological subject), moves towards a goal, and receives or does not receive this goal. The assimilatory nature of an act expresses the status of the system at any given moment, as well as the goal directedness of the act. The operant describes the goal-directedness of the act and the consequences it produces. The realization or nonrealization of the goal of the assimilatory operant results in alternative outcomes. If the goal is directly realized, then, as behavior analysis suggests, the frequency of the act increases (i.e., the process of reinforcement), but there is little variation in the act. From the cognitive-developmental perspective, this means that no transformational change occurs in the system itself (i.e., change in organization).

If a given assimilatory operant does not attain the intended goal (i.e., does not produce a particular consequence), the result is further exploratory action or *variation*. The topographical variation of the act increases until one variant achieves the goal (if the goal is never realized, eventually the act will extinguish). This increased variation and ultimate selection of one variant is critical. Mechanistically minded theorists view this process as *random* variation from which one of the variants is selected by the environment. Relationally minded theorists, in contrast, argue that the variation is constrained by the organization of the system and, hence, represents *organized* variation.

The variation itself opens multiple possibilities and, critically, the variant that achieves the goal provides an action feedback, which results in transformation of the system. Cognitive-developmentalists term the act that results in a transformation of the system 'accommodation,' and accommodation represents the most fundamental process of developmental change. That is, again recognizing the indissociable complementarity of structure and function, accommodation is the functional explanation for transformational changes in mental structures.

In summary, from a cognitive-developmental perspective, with its focus on the mental organization of the person, the process of developmental change broadly proceeds as follows: When faced with a problem, the person is considered to be in a state of nonadaptation or 'disequilibrium.' Disequilibrium leads to exploratory acts, which are themselves a part of the intentional process as they occur when the intended act does not achieve its goal. Eventually one such assimilatory act achieves the goal, resulting in a transformation of the intentional system (accommodation). At this point, adaptation or 'equilibrium' is restored until confronted with the next problem.

The behavior analytic view shares remarkable similarities to cognitive-developmental theory in its understanding of the person-environment interaction that constitute experience and result in developmental change [Gewirtz & Peleaz-Nogeuras, 1996; Schlinger, 1995]. From the behavior-analytic perspective with its focus on the act and its consequences, development is the observed change of the acts

as they occur under environmental selection. In a situation in which an act has produced a particular consequence in the past, that behavior is likely to occur again (i.e., an expression of the current behavioral repertoire). Much like the process of assimilation, if that act produces the reinforcing consequence (i.e., achieves its goal), the act is said to be 'reinforced' from an environmental standpoint. However, similar to the process of accommodation, if the act does not produce the consequence that previously reinforced it, the variability of the act increases until one of the variants produces the consequence and is incorporated into the behavioral repertoire. Behavior analysts describe this process as the means by which novel behavior is acquired, but usually do not extend the explanation to an account of the hierarchical integration and transformational change discussed in cognitive-developmental theory.

There is, in fact, a good deal more to the story of development from a cognitive-developmental perspective. This approach aligns itself with dynamic system models entailing integrative dialectical issues of nonadditivity of organized change, and this nonadditivity entails discussions of the nature of a sequence of emergent discontinuous levels of psychological functioning across the life span. Behavior-analytic theory, in contrast, is generally accepted as a nonhierarchical taxonomy of behavior [Ribes, 1996]. As previously discussed, this aspect of the theory is an issue of emphasis rather than exclusion that stems from its dispersive worldview, and as Morris et al. [1982] have described, behavior-analytic theory has the capability to address developmental phenomena on both empirical and conceptual grounds. Therefore, any extended discussions of these details offer nothing that is irreconcilable with the general proposal that has been offered in this essay for a rapprochement between cognitive-developmental and behavior-analytic approaches to behavior change and development.

Critiques and Consequences

The proposal presented in this essay is abstract, but it is necessarily abstract. The problems that have maintained a split between cognitive-developmental and behavior-analytic approaches were created at the levels of abstract metatheory, and must be resolved at that level. This abstract proposal will hopefully serve as a set of guidelines for those who believe it would be profitable to engage in interdisciplinary theory and research. Critics have asked that we demonstrate specific empirical outcomes that derive from this proposal. We will give two brief examples below. However, it must be emphasized that the abstract framework we propose is offered as a framework within which others can develop their own specific empirical research programs; it is not offered in itself as a concrete empirical research program.

Beyond the issue of the abstract nature of our proposal, several other critical questions have been raised. In the following, we will address these, and then conclude by offering two empirical exemplars of how, among many potential alternatives, our proposal might be operationalized.

All of the critiques offered to this point can be subsumed under the general idea that our proposal for the integration of these two broad domains reflects a biased approach. In point of fact, we must here agree with the critic. Our approach

is biased, but we would argue that any approach must be biased in some way or other, and one must look not at the question of bias *per se*, but at the question of which bias has the greatest probability of furthering the scientific enterprise. Our bias has been explicit throughout. It is a bias that favors an integration/differentiation complementarity as opposed to biases that favor a reductionism according to which one domain is reduced to, made derivative of, or marginalized by, the other domain.

Consider, as one example of this form of criticism, a critic's claim that our proposal is biased because it takes an integrative perspective. But, in point of fact, as we discussed earlier, our proposal is one that offers integration/differentiation, not simply integration. Certainly this is a bias, but it is the only bias that can eventually result in the joining of these two perspectives without the sacrifice of core components of either theory. The critic chooses a different bias, one that makes integration secondary to and derived from differentiation. This is a perfectly legitimate bias – and one that many still hold tightly to – but, we would point out, it is exactly the kind of reductionistic bias that has prevented any true rapprochement between the two theoretical domains.

A second, and similarly reductionistic critique rejects any integration in favor of a *translation* of terms across theories, where the theories maintain their traditional assumptions of contradictory worldviews. Our argument here is two-fold: (a) translation across theories is indeed useful for communication among scientists, but (b) this kind of translation is only possible (and thus useful) in the context of an integration that unites the principles of the two theories while also maintaining their unique identities, thus fostering integrative theoretical progress while at the same time avoiding a 'sloppy eclecticism.'

A related critique argues against any notion of synthesis or integration by asserting that 'from a behavioral viewpoint, mental and behavioral are not opposites, but mental is a class of behavioral (personal communication, anonymous reviewer).' This, of course, is the classical behaviorist bias that eschews any reference to the mental except to define it away as 'nothing but' the behavioral. Finally, there is the critique that argues that one or the other theory already has sufficient conceptual and empirical tools to eventually explain all phenomena described by the other (e.g., the behavioral notion of 'equivalence classes'). But, yet again, here we have nothing but a classic reductionistic bias that adds a temporal dimension (i.e., 'eventually'). For ourselves, we can only repeat that our proposal is designed for those who believe it would be profitable – both conceptually and empirically – to find a way to integrate the two theoretical approaches. Our proposal offers nothing to those who would continue to insist on the reductionistic hegemony of one theoretical approach over the other.

In this concluding section, we will begin to describe two exemplars of how our proposal might serve as a frame to further empirical cooperation between the behavioral-analytic and cognitive-developmental approaches. However, we must again emphasize that our proposal is not designed to lead to any one specific research program; it is designed as a framework within which many research programs might be generated.

The first author's research program, called a competence-procedural approach to the development of logical reasoning, is one such exemplar. Investigations in the area of logical reasoning have traditionally divided themselves into two rival camps:

the mentalist and the behavioral. The mentalists [e.g., O'Brien, 2004], also termed 'competence theory,' have claimed that logical reasoning can only be accounted for by positing a mental system or competence that in some way represents the system of rules that comprise any logic. The behavioral approach [e.g., Cheng & Holyoak, 1989; Johnson-Laird & Byrne, 2002] argues that such a mental system is not necessary, and all the task performances that count as logical reasoning will ultimately be accounted for by, and only by, specific procedures, which are specific acts that occur in real time and are heavily influenced by environmental contexts. The history of this dichotomy is too extensive and complex to be discussed here [see, Overton, 1990; Overton & Dick, in press]; however, it can be said that there is no victory in sight for either of these rival camps. It was into this arena that Overton [1990] proposed a relationally integrated competence-procedural approach. In this approach, both competence and procedures are maintained, but each serve different functions. Mental competence serves the expressive function of logical understanding or comprehension. Competence describes general performance specifications, but it is neutral on how the system is accessed or implemented [Dennett, 1987]. Behavioral procedures serve the instrumental function of logical performance within a wide array of environmental contexts. Procedures describe real-time instrumental behaviors that provide access to and implement competence. Within this integrated approach, Overton and his colleagues launched a series of empirical studies designed to assess the nature and development of mental competence as well as procedural functioning [see Overton, 1990; Overton & Dick, in press, for summaries of the empirical findings of this approach]. Most broadly, findings from both cross-sectional and longitudinal studies have demonstrated that a relatively universal logical competence develops (through the actions of the individual in the world) to maturity at around 18–20 years of age, but that the implementation of this competence is subject to a wide range of procedural situational factors.

A second exemplar of a potential empirical extension of the integrative cooperation between cognitive-developmental and behavior-analytic theories is in the area of language and language acquisition. There are multiple theoretical tensions in the empirical investigation of the acquisition of language, with the most traditional divisions residing between the behavioral (i.e., empiricist) and cognitive or linguistic (i.e., nativist) theories. Theories that align themselves on both sides of this divide have undergone extensive growth and elaboration since the original Skinner-Chomsky debate, and this progress displays a movement toward the theoretical views that each commonly holds as its antithesis. The original dichotomy and absence of integration has isolated the two research programs from one another. Originally, most of the empirical studies involving language acquisition were aimed at providing support of one side of the debate over the other. While working in isolation from one another, each theory has encountered difficulty in accounting for aspects of language acquisition that it traditionally viewed as its antithesis. The cognitive-developmental view of language, while influenced by Chomsky, has extended from an original focus on the grammatical structure and syntax of the individual in isolation to include investigations of semantics – particularly the role of the broader social/environmental context while including the pragmatic function of language [e.g., Bloom & Tinker, 2001; Tomasello, 1992]. The behavior-analytic view of language, while influenced heavily by Skinner, has also found it necessary

to extend from an original focus on the functional analysis of verbal behavior to include an analysis of grammatical structure [Palmer, 1998], language content and meaning [Lowenkron, 2004], and the organized development of the verbal repertoire without direct training of verbal operants [Nuzzolo-Gomez & Greer, 2004]. The extensive empirical insight of cognitive-developmental research programs on the structural aspects of language and the extensive empirical insight of the behavior-analytic research programs on the functional aspects of language could be particularly powerful in an empirical integration that transcends the empiricist-nativist dichotomy.

Summary and Conclusions

As we noted at the beginning of this paper, cognitive-developmental and behavior-analytic approaches to the study of human behavior change and development have historically been conceptualized as incompatible alternative theoretical and methodological perspectives. This split emerges from the acceptance of a metatheory that presents the world through the lens of a series of dichotomous either-or propositions. When the two approaches are recast in a relational metatheory, it becomes evident that they can function productively as an indissociable complementarity. Both approaches represent action theories that take action in the world as the primary process of change and development. The cognitive-developmental approach focuses its research interests on the psychological subject and how intentional acts in the world lead to transformational changes in the mental organization of this subject. The behavior-analytic approach focuses its research interests on the world or environment and how the world selects the subjects' acts. From either a basic or an applied research perspective, knowing the features of the world that serve the goals of intentional acts and knowing features of the person that generate intentional acts is a complementarity that serves the research interests of both the cognitive-developmental and behavior-analytic investigator. For relational metatheory, structure and function constitute an indissoluble complementarity. Privileging the one and marginalizing the other cripples the research process, while treating the two as reciprocally related standpoints opens the door to interesting and valuable multidisciplinary projects.

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