

Still misused after all these years? A re-evaluation of the uses of Bronfenbrenner's bioecological theory of human development

By: [Jonathan R. H. Tudge](#), Ayse Payir, Elisa Merçon-Vargas, Hongjian Cao, Yue Liang, Jiayao Li, and Lia O'Brien

This is the peer reviewed version of the following article:

Tudge, J. R. H., Payir, A., Merçon-Vargas, E. A., Cao, H., Liang, Y., Li, J., & O'Brien, L. T. (2016). Still misused after all these years? A re-evaluation of the uses of Bronfenbrenner's bioecological theory of human development. *Journal of Family Theory and Review*, 8, 427–445. doi: 10.1111/jftr.12165.

which has been published in final form at <https://doi.org/10.1111/jftr.12165>. This article may be used for non-commercial purposes in accordance with [Wiley Terms and Conditions for Use of Self-Archived Versions](#).

***© 2016 National Council on Family Relations. Reprinted with permission. No further reproduction is authorized without written permission from Wiley. This version of the document is not the version of record. ***

Abstract:

A theoretical review published in 2009 revealed that scholars who stated that their research was based on Urie Bronfenbrenner's bioecological theory of human development rarely used it appropriately. To what extent has the situation changed since then? We used the same methods to identify relevant articles as had been used in the 2009 article and found 20 publications whose authors explicitly claimed that Bronfenbrenner provided the theoretical foundation for their study. Although 18 of those publications included citations to the mature (mid-1990s) version of Bronfenbrenner's theory, only two appropriately described, tested, and evaluated the four major concepts of Bronfenbrenner's theory—proximal processes, person characteristics, context, and time. Failure either to correctly describe the theory or to critically test its central concepts poses significant problems for the future of family studies and developmental science. We discuss potential ways to improve this situation through metatheoretical, methodological, and pedagogical reflections.

Keywords: Bioecological theory | ecological theory | ecological systems theory | PPCT model | proximal processes | Urie Bronfenbrenner

Article:

In 2009, Tudge, Mokra, Hatfield, and Karnik published an article in which they evaluated the extent to which scholars were using Urie Bronfenbrenner's theory appropriately in their research. They concluded that very few of the articles said to be based on the theory and published since 2000 did well in either representing the most up-to-date version of the theory (i.e., showing that bioecological theory incorporated the process-person-context-time model) or of applying it in

research practice. Our goal in this article is to assess whether, in subsequent years, scholars have been more accurate in their representation of the theory and more appropriate in their methodological and analytic approach. There is some reason to think that they might be; not only has the Tudge et al. (2009) article been cited quite frequently (more than 200 times between 2009 and January 2016, according to Google Scholar), but also there has been more work published describing the evolution of Bronfenbrenner's theory (Rosa & Tudge, 2013; Tudge, 2013).

Tudge et al. (2009) claimed that it is important for researchers to make explicit their theoretical foundations, accurately represent that theory, and use appropriate methods to test it, so that their work can aid understanding of the theory either by providing appropriate supporting evidence or by calling into question some or all of the theory. Tudge et al. (2009) argued that there are two problems when an empirical study does not adequately represent a theory on which the study is said to be based: "First, it misleads students and fellow researchers about the contents and propositions of the theory, thus providing a flawed heuristic tool. Second, it prevents a fair test of the theory, thus not allowing useful adjustments to be made" (p. 198). We want to stress this second point. The purpose of employing a theory as the foundation for one's research should be not only to determine the variables on which to focus and the methods to employ but also to provide some critical evaluation of that theory. As Meehl (1978) wrote: "Theories in 'soft' areas of psychology lack the cumulative character of scientific knowledge. They tend neither to be refuted nor to be corroborated, but instead merely fade away as people lose interest" (p. 806). Neither refutation nor corroboration is possible either when the theory is misrepresented or when inappropriate methods are used. Demo and Buehler (2013) made a similar plea regarding family theories, noting that although in the past they have been used primarily as the study's frame or lens, theories instead need to serve as the foundation for the explicit, systematic, and deliberate testing of hypotheses.

Bronfenbrenner's Bioecological Theory

Bronfenbrenner (2001) defined his bioecological theory as "an evolving theoretical system for the scientific study of human development over time" (pp. 6963–6964).¹ It incorporates a four-element model, involving the synergistic interconnections among proximal processes, person characteristics, context, and time (the PPCT model). In other words, as he wrote, these four elements simultaneously influence development; their effects are not merely additive because they are a part of "an interactive system" (Bronfenbrenner, 1999, p. 10). As Bronfenbrenner and Ceci (1993) noted in the first published definition of proximal processes, "human development takes place through processes of progressively more complex reciprocal interaction between an active evolving biopsychological human organism and the persons, objects, and symbols in its immediate environment" (p. 317). They went on to write:

The form, power, content, and direction of the proximal processes that affect development vary systematically as a joint function of the characteristics of the

¹ We summarize the important concepts of the most recent version of the theory stemming from Bronfenbrenner's writings from the 1990s onwards; however, we do not provide detail about the ways in which his theory changed from an ecological to a bioecological theory, as that was briefly discussed in Tudge et al. (2009) and covered in some depth by Rosa and Tudge (2013).

developing person and the environment (both immediate and more remote) in which the processes are taking place and the nature of the developmental outcomes under consideration. (Bronfenbrenner & Ceci, 1993, p. 317)

It is worth stressing that this notion of the interdependent nature of all elements that make up a system was a part of Bronfenbrenner's thinking as early as the 1970s. "In ecological research, the properties of the person and of the environment, the structure of environmental settings, and the processes taking place within and between them must be viewed as *interdependent and analyzed in system terms*" (Bronfenbrenner, 1979, p. 41, emphasis added).

Proximal processes were given pride of place, being considered the engines of development by Bronfenbrenner and Morris (1998), and the same authors described three types of person characteristics (demand, resource, and force characteristics) that, in different ways, influence what occurs during proximal processes. As for levels of context, they had been defined by the mid-1970s (Bronfenbrenner, 1976), and the famous four "systems" of micro-, meso-, exo-, and macrosystem were subsequently incorporated in each of the three main phases in the development of the theory (Rosa & Tudge, 2013). The final element of the PPCT model, time, was also discussed during the 1970s (Bronfenbrenner, 1975, 1979) but was highlighted increasingly during the 1980s, until being formally attached to the PPCT model in the third and final phase of the theory's development, as comprising three different layers (micro-, meso-, and macrotime). Full details of the theory, earlier variants, and the mature form (including the PPCT model) are in Rosa and Tudge (2013).

Bronfenbrenner wrote no methodological primer for how to conduct ecological or bioecological research. However, from the way he wrote about the PPCT model and illustrated how it could be applied (see, e.g., Bronfenbrenner, 1995, 1999; Bronfenbrenner & Morris, 1998, 2006), drawing on others' research, it is clear what he thought the basic elements of any study using bioecological theory should be.

First, there must be a focus on the relevant proximal processes that are hypothesized to be involved in the developmental outcome of interest. For example, in a study (Drillien, 1964) discussed in many of Bronfenbrenner's articles from the 1990s (e.g., Bronfenbrenner, 1994), the quality of mother-child interaction (as assessed by observation) was used to show the powerful effect of these proximal processes on the outcome of interest (the children's behavior problems in school). Second, to understand the ways person characteristics influence those proximal processes, at a minimum there have to be two levels of a single characteristic. Bronfenbrenner noted that Drillien had hypothesized that the child's birth weight (very low, low, or normal) would influence the quality of interactions. In this study, therefore, different levels of a resource characteristic were used. Third, to understand the ways context influences proximal processes, researchers need to include in their design two or more groups hypothesized to be relevant to the proximal processes being considered. As described by Bronfenbrenner (1994), Drillien recruited participants from three social classes (low, middle, and high) because she believed that social class, in combination with the birth-weight status of the child, would influence the quality of mother-child interactions. Finally, regarding time, any developmental study should be longitudinal; in the case of Drillien's research, the data on problem behaviors were collected 2 years following the observation of interactions. Although Bronfenbrenner (1999; Bronfenbrenner

& Morris, 1998) did not discuss this with reference to Drillien's work, he pointed out, specifically with regard to Elder's (1974) research, the importance of understanding the sociohistorical time in which a study is conducted. He had discussed this issue in one of his earliest articles (Bronfenbrenner, 1958) as well, showing how parental values associated with middle- and working-class families changed over the course of time.

To summarize, appropriate use of Bronfenbrenner's bioecological theory requires a focus on proximal processes, a means to show that these proximal processes are simultaneously and synergistically influenced both by person characteristics (a minimum of two levels, for example, high and low levels of motivation) and by the context (a minimum of two relevant contexts), and the study should be longitudinal. Research incorporating these characteristics at least has the potential to allow scholars to test theoretically relevant hypotheses and to evaluate, critically, the theory in light of the results obtained. Many scholars state that their research is explicitly based on Bronfenbrenner's theory, and some treat this as one of their study's strengths; to what extent are their claims accurate?

Placing Bronfenbrenner's Theory Into Metatheoretical Perspective

Theories such as Bronfenbrenner's might be particularly prone to misrepresentation and a lack of appropriate evaluation, given that it is a contextualist theory that is too often treated as though it fits within a mechanist paradigm (see Tudge et al., 2009). To clarify this distinction, it is worth examining the metatheoretical underpinnings of the main theories used in the fields of family studies and developmental science. As Pepper (1942) argued, in the field of psychology there are three main (and a little-used fourth) worldviews, or paradigms, which he termed *mechanism*, *organicism*, and *contextualism*. Pepper's terminology is confusing, to say the least: The term *organicism* seems to imply that development comes from within the organism, and *contextualism* implies a focus on the contexts in which development occurs. Neither supposition is correct. The major ontological and epistemological difference between mechanism and the other two paradigms has to do with the type of causal mechanism assumed to underlie human development. Mechanists accept the idea of efficient (environmental) and material (genetic, biological, physiological) causes, whereas organicists and contextualists hold that causes are formal (i.e., causes can never be reduced to either efficient or material factors; development results from the synergistic interaction of both).

This is a critical distinction. On the one side, mechanists argue that to understand means to simplify what is complex, to break things down to examine what are assumed to be separate causal factors. Treating Bronfenbrenner's theory as one of the effects of the context on individual development is thus to treat it as a mechanist theory. The mechanist paradigm is one "in which foundationism, atomism, and reductionism are bedrock concepts" (Overton & Lerner, 2012, p. 376). On the other side are organicists and contextualists, with proponents of both paradigms accepting formal causes, those that emerge from the synergistic relations among variables—that is, relations in which the outcome is greater than the sum of the variables.

There is, however, also a distinction between organicists and contextualists that should not be blurred. The former, but not the latter, hold that there are "final" causes—that is, that there is a directionality to development and that individuals typically go through stages in a given order

(Goldhaber, 2000; Pepper, 1942). As Pepper (1942) noted, and as Overton and Ennis (2006) made clear, “the final explanatory principle [i.e., final cause] accounts for directional changes in the structures of the functioning system” (p. 160). The theories of Erikson, Werner, and Piaget are prime examples of organismic theories. Contextualist theories, such as those of Vygotsky and Bronfenbrenner, have no such universal end point of development in view; rather, what counts as competent development will vary in part according to situation- or culture-specific pressures.

Since the early 1970s (see, e.g., Overton, 1984; Overton & Reese, 1973; Reese & Overton, 1970), Overton has argued that contextualism, lacking the idea of a developmental end point, is not an appropriate paradigm for developmental science, and that in its “strict contextualist” form—namely one in which context and individual are treated as separate, having an impact via efficient causes (Overton, 2013)—it should be linked with mechanism. In its weaker form it should be allied with organicism, he argued, and Overton (2007) called his dynamic systems approach “relational organicism-contextualism,” and he and his colleagues (e.g., Overton, 2013; Overton & Ennis, 2006) have treated the relationist worldview as comprising “integrated organicism-contextualism” (Overton, 2013, p. 53). As Overton and Lerner (2012) wrote about the relational developmental systems (RDS) paradigm:

The world is conceived as a spontaneously active (dynamic), changing (developing), relational, holistic (integrated) system.... The relational nature of the system emphasizes causality as bi- or multidirectional ($\leftarrow \rightarrow$). All facets of the individual and the context exist in mutually influential relations. (p. 376)

However, Overton's RDS paradigm appears to constitute another variant of Pepper's (1942) organismic worldview rather than a combination of organicism and contextualism. What Overton (2013) termed the “five defining features” of the development process are “(1) *non-linearity* (i.e., inputs are not proportional to outputs), (2) *order* and *sequence*, (3) *direction*, (4) *relative permanence* and *relative irreversibility*, and (5) *epigenesis* and *emergence*” (p. 53, original emphasis). Although organicist theories such as Piaget's, Erikson's, and Werner's include each of these features, Bronfenbrenner's theory (like that of Vygotsky, similarly critiqued) clearly does not, and he consigned it to the mechanist camp.

As Tudge et al. (2009) and Rosa and Tudge (2013) made clear, however, even in the 1970s Bronfenbrenner's theory was ecological, with development having to do with emergent properties stemming from the interaction of individual and environment. By the early 1990s, and the introduction of proximal processes and the PPCT model of the bioecological theory, there was even less reason to view the theory as one of independent effects (as required by mechanist theories). Overton (2013, 2015) provided no direct evidence supporting his placement of Bronfenbrenner into the mechanist camp; instead, he seems to have relied on Mistry and colleagues (Mistry, Contreras, & Dutta, 2012; Mistry & Dutta, 2015) and their interpretation of the theory. In both chapters Overton (2015) quotes the same passage regarding Bronfenbrenner's bioecological approach:

Culture is represented as the outermost layer of context or macro-system. Although this model has conceptually focused on the interplay among the various layers of the context (i.e., psychological, biological, cultural, historical, institutional), empirically, the specific

layers have been treated as split-off independent variables that influence behavior and development as efficient causes. Thus, culture is conceptualized as a feature of environmental or ecological context that exists independent of the person. (Mistry & Dutta, 2015, p. 370, as cited in Overton, 2015, p. 25)

The “specific layers” of context do not, in fact, act as efficient causes but can only ever exert an influence in the course of proximal processes—at the same time, therefore, as the individuals engaging in those proximal processes exert an influence. Development, in Bronfenbrenner's bioecological system, occurs because of the synergistic relation between individual and context in the course of proximal processes. Bronfenbrenner and Morris (2006) stated explicitly that the two “propositions” (relating first to proximal processes and second to the way they are synergistically influenced by the participating individuals, context, and time) “are theoretically interdependent and subject to empirical test. An operational design that permits their simultaneous investigation is referred to as a Process-Person-Context-Time (PPCT) model” (p. 798).

It is worth noting, however, that Lerner (2015; Lerner, Johnson, & Buckingham, 2015) includes Bronfenbrenner's theory within the RDS paradigm, as indeed did Lerner and Overton (2008). Lerner (2015) argued that from the early 1970s Bronfenbrenner's ecological approach was bidirectional, early evidence of “a burgeoning conception of the interrelated, mutually influential relations between individuals and contexts that define the basic processes of human development” (p. 166). Similarly, but writing about Bronfenbrenner's theory from the mid-1990s, Lerner et al. (2015) noted: “In the PPCT model, the *process* of development involved mutually influential relations between persons and contexts” (p. 86).

There is clearly some difference of opinion, then, as to whether Bronfenbrenner's theory can be said to fit within the RDS paradigm. Perhaps the more serious problem is the attempt to dichotomize what for Pepper (1942) are three different paradigms, none of which can be subsumed into any of the others. As Tudge has argued (e.g., Rosa & Tudge, 2013; Tudge, 2008; Tudge et al., 2009), Bronfenbrenner's theory fits within the contextualist paradigm, as it clearly accepts the idea of formal cause and does not accept the notion of a final cause.

Given differences at the ontological and epistemological levels, there also should be equivalent differences at the level of method. For mechanists, sometimes termed *neo-positivists* (Tudge, 2008), this essentially means carefully controlling variables to ensure that the separate effects of each can be identified and measured. Classic experimental studies are good examples in which all is held constant but the one or more variables that are being studied. In quasi-experimental or nonexperimental studies control may be exercised statistically. Interaction effects are of course possible, but interaction is meant in the sense of statistical interaction, as when the effects of one variable are moderated by those of another.

The methods employed by organicists and contextualists should be quite different from those used by mechanists. Believing in formal causes, or development being the result of the emergent properties arising from the interaction of two or more factors, there is no point to try to control variables to see their effects independent of the others; there are no effects that are independent of others. The goal is to try to understand the joint, synergistic effects of several relevant

influencing factors. However, conducting research in a climate of simplification means that the complexity inherent in contextualist or organicist theorizing is too often reduced to methods that, while simpler to apply, are simply inappropriate. In other words, any research that reduces Bronfenbrenner's theory to the independent effect of context on development is misguided, treating his theory as mechanist rather than contextualist.

To distinguish organicist and contextualist methods, the former, but not the latter, should be concerned with three of the “defining features” that Overton (2013, p. 53) provided: order and sequence, direction, and relative permanence and relative irreversibility (each of which has to do with final cause). The other two that Overton (2013) mentioned, namely “that inputs are not proportional to outputs” (p. 53) and that epigenesis and emergence are related to formal cause, thus are relevant to both organicism and contextualism.

Too often, as others (e.g., Abend, 2008; Thomas, 1997) have argued, the terms *theory* and *theorizing* are sloppily used, often without much or any concern with the relation between the study's theoretical “foundation” and the empirical data gathered and analyzed. O'Brien (2005) contrasted the mismatch between our field's “contextual and dynamic” worldview (a worldview that involves “a complex system of reciprocal influence”) and research that examines “direct or linear effects of individual or contextual characteristics on some outcome that is described as if it were static and immutable” (p. 888). This seems to be the case with the way in which Bronfenbrenner's theory is typically used. As we have shown, it is a contextualist theory that is too often treated, for research purposes, as though it is mechanist.

Our intent in this article is therefore to extend the critique of Tudge et al. (2009) for articles published from 2010 onward in which the authors explicitly stated that their research was based on Bronfenbrenner's theory (rather than simply citing it) and to categorize the studies according to whether the authors at least referred to the mature version of the theory and, if so, how they used the theory in their research. Our consideration of metatheoretical issues is used to highlight some of the problems we identify.

Literature Review

Method

We used the same methods reported by Tudge et al. (2009) to search for relevant publications. That is, we conducted an online search (including PsycINFO, EBSCOhost, ProQuest, and Google Scholar) using the following keywords, separately and in combination: *Bronfenbrenner*, *ecological theory*, *ecological systems theory*, *bioecological theory*, and *PPCT model*. Although Bronfenbrenner originally termed his approach ecological in the 1970s and for most of the 1980s, then described it as ecological systems theory in 1989 and as bioecological theory in 1993, many authors seem to use the names interchangeably. To be fair, Bronfenbrenner himself was inconsistent in his use of terms, most often calling it a bioecological model (see Bronfenbrenner & Ceci, 1994; Bronfenbrenner & Morris, 2006) or a bioecological theory (Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1993), but also once naming it ecological systems theory (Bronfenbrenner, 2000).

We eliminated any articles that were published before 2010 or were published in a language other than English. We also eliminated all articles whose authors simply cited Bronfenbrenner's work or theory—we included only articles whose authors explicitly stated that they were using his theory as the basis for their study. We arrived at a total of 20 journal articles published between 2010 and April 2015 that met our requirements. In five cases, authors stated that they were using Bronfenbrenner's theory in conjunction with another (Baker & Iruka, 2013; Galindo & Sheldon, 2012; Grogan-Kaylor & Woolley, 2010; Poehlmann et al., 2011; Votruba-Drzal, Coley, Maldonado-Carreño, Li-Grining, & Chase-Lansdale, 2010).

Analysis and Discussion

After reviewing the 20 articles, we determined that each of them could be categorized into one of five different types. However, it is important to be clear that in no way are we critiquing the actual research conducted by any of the authors included in our review; our concern is with the theory–research linkage. Much as we value theoretically driven scholarship, there also is value in building up a body of empirical research. The results reported in these studies are both interesting and important.

Table 1. Evaluation of the Extent to Which Authors Adequately Used Bronfenbrenner's Bioecological Theory

Articles Evaluated							
Citations only to the 1970s	Hemar-Nicolas et al. (2013)	Leonard (211)					
Citations only to the mature theory, but no discussion of PPCT	Baker & Iruka (2013)	Behnke et al. (2011)	Bowen et al. (2012)	Boxer et al. (2013)	Galindo & Sheldon (2012)	Hendricks et al. (2014)	
PPCT only mentioned in the introduction	Ayón et al. (2010)	Grogan-Kaylor & Wooley (2010)	MacNeil & Adamsons (2014)				
Study variables related to PPCT but no attempt to test PPCT	Chien & Mistry (2013)	Maynard et al. (2014)	Nobre et al. (2014)	Ochoa (2014)	Poehlmann et al. (2011)	Votruba-Drzal et al. (2010)	Williams & Nelson-Gardell (2012)
Appropriate testing and evaluation of PPCT model	Benson & Buehler (2012)	Farrant & Zubrick (2010)					

First, as Tudge et al. (2009) found, some scholars in the present review simply said that they were using Bronfenbrenner's theory but cited only his work from the 1970s and 1980s. Second, authors cited one or more of his publications describing the mature version but did not mention any of the PPCT concepts related to that version. This set of articles, we think, demonstrates a lack of awareness of the fact either that the theory significantly changed from the early 1990s or that the PPCT model involves an interplay of the theory's crucial concepts. Third, a further set of authors cited his work from the 1990s and described, at a minimum, proximal processes (the single most important concept of the PPCT model). However, these authors restricted their comments on the model to the introduction rather than including the relevant concepts in the research itself. Fourth, some authors cited PPCT concepts and referred to them in their study, but

apparently without intending to use them to test the model. Rather, the study variables seem to have been simply “draped” over the relevant theoretical concepts—for example, when data are collected in a specific context and this is viewed as satisfying the context requirement of the PPCT model. Fifth, there is a set (admittedly quite small) of authors who not only cited the theory and its central concepts but also tested some parts of the PPCT model. The summary of our analysis of these articles can be found in Table 1.

Citations only from the 1970s. Two of the 20 papers (Hemar-Nicolas, Ezan, Gollety, Guichard, & Leroy, 2013; Leonard, 2011) cited Bronfenbrenner's work only from the 1970s, and both treated the theory as though it fit within the mechanist paradigm. Hemar-Nicolas et al. (2013) stated that they were “drawing on Bronfenbrenner's ecological model” (p. 5) and included, as a keyword, *ecological systems theory*, but cited only Bronfenbrenner (1979) as the source for their work. They seem to have used Bronfenbrenner solely as a means to discuss how the different levels of context influence the child, and the subsequent impact on childhood eating and obesity. Interestingly, the authors incorporated the term *ontosystem*, defined as “the child with his/her innate or acquired physical, emotional, intellectual, or behavioral characteristics” (p. 7), into their discussion as though it were a part of Bronfenbrenner's terminology.

Similarly, Leonard (2011) wrote that he was using Bronfenbrenner's ecological theory, also termed *ecological systems theory*, and “Bronfenbrenner's theory of the concentric circles” (p. 995), to understand school–community partnerships. Not surprisingly, given the last description of the theory, the study simply examines relevant microsystems, some interesting mesosystems (home, school, and place of work), with some discussion of the exosystem and macrosystem. The only citation is to Bronfenbrenner's 1979 book.

Citations of the mature version of the theory but without discussion of any aspects of PPCT.

The following six sets of authors cited at least some of Bronfenbrenner's theoretical writings from the mid-1990s onward, but we are not convinced that these articles constitute much of an improvement on the two placed into the first group, at least in terms of the use of theory. Although some of the authors discuss interactions (e.g., parent–child interaction), these interactions are not treated as contextualist theories require—enabling scholars to examine the ways in which parent and child synergistically shape proximal processes. The theory, as noted earlier, is viewed as a mechanist theory.

Each of the following set of authors cited at least one of Bronfenbrenner's articles from the mid-1990s or later or Bronfenbrenner's 2005 book (a collection of papers from the 1970s to 2001) in which the mature version of the theory was described, and so had apparently read about the importance of proximal processes in relation to the other parts of the PPCT model. However, even if the term *proximal process* was used, it was neither related to the concept as Bronfenbrenner defined it nor treated in combination with any of the other PPCT constructs.

Baker and Iruka (2013) stated that their work was guided by bioecological theory and family stress theory. They did cite Bronfenbrenner and Morris (1998), and they referred to proximal processes as follows: “proximal processes such as mother–child interactions can attenuate or advance opportunities for optimal academic achievement” (p. 510). However, nowhere did they consider proximal processes as part of a PPCT model, and their only other references to the term

are to the “proximal processes of parenting,” with the only Bronfenbrenner citation being that of a 1986 article, when the bioecological concept of proximal processes had yet to be defined. It thus seems unlikely that they were using the term in its PPCT sense. Of more concern, however, from a theoretical point of view is that the research itself (whether the home environment mediated the association between maternal psychological functioning and African American children's school performance) was not linked in any explicit way to any of the elements of the PPCT model. With no further mention of bioecological theory, the authors' discussion stated: “More research is needed that examines the differential relations between maternal depressive symptomatology and parenting practices within a cultural–ecological framework in order to fully understand these associations among different racial, ethnic, and socioeconomic groups” (Baker & Iruka, 2013, p. 516).

Behnke, Plunkett, Sands, and Bámaca-Colbert (2011) also stated that their research, into Latino adolescents' self-esteem and depression, was “guided by Bronfenbrenner's bioecological framework” (p. 1179). They noted that scholars had recently started to use this model “to guide their understanding of the complex interrelationships between depressive-related problems and factors found at different contextual levels, such as individual, familial, neighborhood, and macrolevel qualities” (p. 1180). Although their measures could have been related to at least one person characteristic (adolescent gender), proximal processes (degree of parents' support and level of culture conflict), and context, they made no attempt to link these factors to aspects of the PPCT model (proximal processes, for example, were not mentioned at all). The authors concluded that their findings “could be interpreted through the lens of cognitive therapy ... or hopelessness theory” (p. 1189), with no mention of Bronfenbrenner.

The study by Bowen, Moring, Williams, Hopper, and Daniel (2011) into methamphetamine addiction among adults was also described as being guided by the bioecological model, which was “useful for classifying initiating influences and grouping individuals based on different combinations of influences” (p. 286). However, although the authors cited Bronfenbrenner and Evans (2000), and the same publication was used as one of the citations describing how the “interview was developed using Bronfenbrenner's ecological model” (p. 288), the section describing the theoretical framework seemed to rely solely on Bronfenbrenner (1977). Not surprisingly, then, the five “influences” that the authors described included the individual “nested” within the four systems (micro, meso, exo, and macro), and the results and discussion relied solely on these same five influences.

Boxer et al. (2013), studying the development of aggression as a result of increasing exposure to violence in Palestine, stated that they were basing their hypotheses on Bronfenbrenner (1979), although they recognized that the theory had changed since 1979. However, their only acknowledgment of the nature of the changes was as follows: “Bronfenbrenner's [2005] later work more explicitly recognized those reciprocities, with greater attention to the biological and predispositional characteristics children bring to bear on their social experiences” (p. 164). This statement is true; however, it is misleading in its implication that this “later work” merely strengthens the child–environment reciprocity aspect of the theory. Although the study includes variables that are clearly relevant to the PPCT model (they could have examined children's repeated exposure to violence as a proximal process, they could have treated age as a person characteristic influencing that process, they have data from various types of context, and the

study is longitudinal), the authors made no attempt to examine their variables from a PPCT perspective.

Galindo and Sheldon (2012) stated that they used both Bronfenbrenner's ecological theory and Epstein's (2001) work on home and school linkages to focus on family–school connections, family involvement, and children's school achievement. Bronfenbrenner and Morris (1998) were cited to the effect that “children's behavior and development are influenced by their interactions within each context, as well as the connections between settings” (Galindo & Sheldon, 2012, p. 90). Despite this, there was no mention of proximal processes, and any attempt to examine how these interactions might be influenced by person characteristics or context was ruled out by using theoretically important factors (social class, as measured by parents' education and income, family type, and the racial/ethnic composition of the school) simply as control variables in their research. Time was included, given that the study was longitudinal.

Hendricks, Lansford, Deater-Deckard, and Bornstein (2014) investigated the relations between child disabilities and caregiver discipline in low- and middle-income countries, stated that their study was guided by the ecological perspective, and cited Bronfenbrenner (2000) in addition to two of his publications from the late 1970s. However, they described the theory in the following way:

In the social bioecological model of development, children are embedded within various sociocultural systems that interact either to support or hinder their development. These dynamic systems are conceptualized as different spheres of influence and include those that have a distal (i.e., indirect) and proximal (i.e., direct) effect on the individual. (Hendricks et al., 2014, p. 513)

The authors did recognize that all of these various systems “are constantly interacting, and the parent–child relationship is best conceptualized within this transactional context” (Hendricks et al., 2014, p. 514), but the citation is to Bornstein (2009) rather than Bronfenbrenner. As might be expected from this characterization of bioecological theory, the research itself focuses on the impact of both distal and proximal influences on children, and parents' disciplinary practices are treated as a component of family environment rather than the interaction between parents and children. Finally, although the authors noted the problem of conducting a cross-sectional study, they did not describe this as a theoretical limitation.

Consideration of PPCT restricted to the introduction. In three articles, authors described at least some parts of the PPCT model in the introduction but then failed to consider them in the research itself, meaning that it is difficult to view the study as a way to test a contextualist theory. Ayón, Marsiglia, and Bermudez-Parsai (2010), exploring the role of *familismo* and discrimination in Latino families, stated in their theoretical framework that their study was “informed by the ecological perspective (Bronfenbrenner, 1979)” (p. 745). However, they also cited Bronfenbrenner and Ceci (1994), noting that “proximal process or interactions with others and various structures occur within the context of multiple environments and over time” (p. 745). Unfortunately, from a theoretical point of view, Ayón et al. (2010) did not try to analyze how these proximal processes (e.g., interactions around *familismo*) were influenced either by person characteristics or by aspects of the context (relevant variables were simply included as controls

in their regression analysis). Time was assessed simply as length of time the families had lived in the United States, as the authors used only baseline data from a longitudinal study. In their concluding remarks, the only reference to their theoretical framework was the following: “Consistent with an ecological approach multiple systemic factors should be considered including the mezzo environment” (Ayón et al., 2010, p. 753).

Grogan-Kaylor and Wooley (2010) described the “ecological perspective” that they used, stating that their “current research was informed by Bronfenbrenner's (200[5]) bioecological theory of human development” (p. 878). Nonetheless, they wrote that the theory “offers a dynamic map of the multiple contexts of child development[,] ... each with varying degrees of influence on the developing child” (p. 878), and stated that their research “examined variables that have an impact on micro- and mesosystems-level influences on the developing child” (Grogan-Kaylor & Wooley, p. 879). These variables were specifically referred to as proximal processes, again citing Bronfenbrenner's 2005 book, categorized as either protective or risk factors. When describing their analytic plan, the authors wrote that it “draws upon” their theoretical perspective, namely “to examine the differential influence of the social environment across the micro-, meso-, and macrosystem levels” (Grogan-Kaylor & Wooley, p. 885). “Family process and family interaction” were added to the model “to assess the contribution of these proximal social processes to children's academic outcomes” (Grogan-Kaylor & Wooley, p. 885). It is possible that one or more of the four measures of family process (family satisfaction, family support, family integration, home academic culture) could be considered proximal processes, but no attempt was made to determine how these processes were influenced by either person characteristics or the context. The only comment regarding any of these processes was to the effect that only home academic culture had an influence on children's grades. The results and discussion, in fact, focus almost entirely on micro-, meso-, and macrosystem influences.

MacNeil and Adamsons (2014) examined the difference between same-race and interracial couples' conflict management strategies, perceived social support, and relational satisfaction. They stated: “Of particular relevance to the current study is Bronfenbrenner's (2005) person-process-context-time (PPCT) model” (MacNeil & Adamsons, 2014, p. 244). However, rather than placing proximal processes at the forefront (both literally and figuratively), they continued the sentence as follows: “in which multiple contextual and personal elements work together to shape an individual's development” with no mention of proximal processes. This statement sounds as though the authors were thinking of the theory as a contextualist one, but the analytic strategy employed was not contextualist. The focus of their study was on couple interactions around managing conflict, and although this could have been considered the proximal process of interest, conflict management strategies were considered person characteristics, and interpersonal interactions were simply treated as part of the microsystem. It is perhaps telling that although Bronfenbrenner's 2005 book was used as the reference for the PPCT model, most of the citations were to his 1979 book.

Study variables related to PPCT, but not to test the model. A total of seven articles are in this group of having PPCT-related variables, but not using those variables to test the model, and these authors recognize that the theory, not dealing with simple cause-and-effect relations, does not fit within mechanism. Nonetheless, using the theory as a study's foundation should, we believe, mean an attempt to test that theory using the data gathered. Chien and Mistry (2013)

cited Bronfenbrenner and Morris (2006) and stated that the bioecological perspective informed their research, although they made no mention of the PPCT model. Their study focused explicitly on proximal processes, however, as they sought to show how contextual factors (cost of living and family income) influenced “three types of proximal processes within the family microsystem—family stress, parental investments, and school resources—that mediate the relations between cost of living, family income, and child well-being” (Chien & Mistry, 2013, p. 210). Even without considering the element of time (the study was not longitudinal), the authors attempted to see the effect both of contextual factors (e.g., family income) and person characteristics (e.g., gender) on child well-being. Despite claiming in the discussion that “this study used bioecological theory to demonstrate how proximal processes... within a child's microsystem and macrosystem (cost of living and family income) combine and interact to influence child development” (Chien & Mistry, 2013, p. 223), they made no attempt to link the findings to the theory, in either a supportive or a critical fashion.

Maynard, Beaver, Vaughn, DeLisi, and Roberts (2014) were explicit about the model and its importance for their study of the relation of genetic and environmental factors in school engagement. The authors clearly described proximal processes, influenced both by biological or genetic and environmental characteristics, noting as well that attention must be paid to the fact that environments change over time. The authors stated, “The bioecological model is especially well suited as a framework for this study” (Maynard et al., 2014, p. 166). This longitudinal study appropriately incorporated both resource and force person characteristics, several related microsystems (examining both shared and nonshared environments), and measures of interaction (academic, behavioral, and emotional engagement), which enabled the authors to assess process. However, the theory was discussed again only in the implications section of the article, with no critical analysis of the theory from the perspective of their data.

Nobre, Coutinho, and Valentini (2014) also used bioecological theory to assess the motor development of children in Brazil's Northeast, and laid out very clearly the main elements of the PPCT model. They specifically drew attention to the fact that the power of proximal processes to influence development “varies substantially as a function of the characteristics of the person, the immediate and remote contexts, and the time periods in which the processes occur” (Nobre et al., 2014, p. 264). This article was the only one of the 20 in which the proximal processes of interest were children engaging in physical activity; although most researchers focus on interaction with others, Bronfenbrenner often noted (e.g., Bronfenbrenner & Morris, 1998) that proximal processes could involve other people, objects, or symbols. The authors noted that their results would be “interpreted in the light of the Bioecological Model” (p. 265), and they linked their various findings to one or other aspect of PPCT.

It is one thing to gather data from the microsystem where the children are exercising and to report on the macrosystem in which the study is set but quite another to examine how exercise (or any other proximal process) varies as a result of being in one or other microsystem (or macrosystem). For that to happen, there must be a minimum of two microsystems (or macrosystems). The same is true for person characteristics. Although Nobre et al. (2014) described differences in exercise patterns for boys and girls, they did not examine exercise patterns that differed as a function of “motor proficiency” (the main person characteristic of interest). Similarly, they primarily treated time as differences in chronological time (it was not a

longitudinal study), although the study was one of only two to clearly place its findings into the sociohistorical period. These authors, in fact, seemed to use the various elements of process, person, context, and time as categories into which they fit their data, rather than allowing for their data to test the theory.

Ochoa (2014) provided a detailed account of the main aspects of the PPCT model before drawing on it to examine working-class Filipino parents' socialization of moral behavior in their children. Parents' socialization practices were treated as the proximal processes of interest, and she wanted to show how those processes were simultaneously influenced by characteristics of the children (their age and gender) and by context (poverty and Filipino culture). As in Nobre et al.'s (2014) study, Ochoa (2014) treated time primarily ontogenetically, although she also examined it in its sociohistorical sense, showing how parental practices had changed since the parents themselves were raised. As mentioned with regard to Nobre et al.'s (2014) work, however, no assessment could be made of the role of context, given that only one context (poor and Filipino) was studied. Toward the end of her article Ochoa (2014) wrote:

The findings of this study identify elements within the person, process, context, and time relevant to moral behaviors. It also recognizes parent socialization as a proximal process influenced by the person, context, and time. With this identification comes the next challenge of creating a testable model that can further explain the relationship among these variables. (pp. 64–65)

We would argue that the PPCT model is, and should be, testable and could have been partially tested (with the exception of context) with Ochoa's data.

Poehlmann et al. (2011) cited both Bronfenbrenner (Bronfenbrenner & Ceci, 1994) and Sameroff (Sameroff & Fiese, 2000) as examples of the “ecological models ... that provide the theoretical basis for this work” (p. 91). Although there are obvious similarities between the two theories, the differences are great enough that testing one of them is not the same as testing the other. As no obvious attention was paid, subsequently, to any of Sameroff's ideas, it is not clear what purpose the citation served. The authors laid out the main elements of the PPCT model without actually mentioning the model itself:

Ecological theories stress the importance of bidirectional influences at multiple contextual levels of development, emphasizing the importance of child factors, parenting processes, and socioeconomic (SES) influences. Biological factors, such as infant physiological regulation, are seen as key contributors to proximal processes, or the day-to-day interactions with parents that facilitate infant development (Bronfenbrenner & Ceci, 1994). (Poehlmann et al., 2011, p. 91)

Although Poehlmann et al. (2011) had data to test the theory and critically evaluate the PPCT model, they did not do so.

Votruba-Drzal et al. (2010) also laid out the key elements of the PPCT model, having stated that their study was “grounded in bioecological models of development” (p. 1461). Interestingly, they also cited Sameroff (1994) along with Bronfenbrenner and Morris (1998), but like Poehlmann et

al. (2011), they provided no details about Sameroff's theory, as though the theories were equivalent. Proximal processes were described succinctly, as were the interrelations of person characteristics, context, and proximal processes. The latter were measured by the quality of interactions experienced by children in child care, hypothesized to be influenced by child characteristics (gender and race/ethnicity) and by the most relevant microsystem (type of child care), and gathered their data over time. The authors, moreover, returned to the theory in their discussion:

Based upon bioecological theory that suggests that the effects of contextual experiences may differ in response to characteristics of the individual, we hypothesized that child gender and race/ethnicity may moderate links between child care and children's development of behavior problems. Our results supported that hypothesis. (Votruba-Drzal et al., 2010, p. 1469)

They made no other attempt, however, to evaluate the theory in light of their results.

Williams and Nelson-Gardell (2012) were explicit in their abstract: "Using Bronfenbrenner's Process-Person-Context-Time (PPCT) model, this study considered the proximal and distal factors that would contribute to adolescents' reactions to sexual victimization" (p. 53). The authors carefully described each of the four components of the model, although time was said to relate only to the "timing of transitions" rather than having to do either with sociohistorical time or with collecting data over time.

However, despite stating that they were "relying on the PPCT model as a theoretical framework," they continued by saying that the purpose of their study "was to empirically examine a contextual model that predicted resilience in sexually abused adolescents. This model was designed to encompass the full contextual scope [of] the PPCT model" (Williams & Nelson-Gardell, 2012, p. 56). In the course of laying out this "contextual model," each of their variables was placed within one or other of the four components of PPCT, although it is difficult to see how some of these variables actually fit. For example, under proximal processes they fit caregiver perception of social support and quality of peer relationships; relationship of the perpetrator to the child and number of caregivers available to the child were located within context; and time since abuse was the only aspect of time that was considered. The authors hypothesized that their measures of proximal processes would have the greatest impact on resilience, and this hypothesis was supported. What they did not try to do, however, was examine the ways in which person characteristics and/or aspects of the context influenced proximal processes. Essentially, the PPCT model was used as a set of hangers onto which each of their variables could be hung, rather than as a theoretical model for development to be tested.

As mentioned earlier, we think that much of this research is both important and interesting. However, what we are looking for are studies that not only carefully lay out the various aspects of the PPCT model but also test them as a way of either providing support for or casting doubt on aspects of that model. The following studies certainly take us in that direction.

Appropriate uses of the PPCT model, including evaluation. The final set of articles, we believe, provided the best examples of how to use Bronfenbrenner's theory appropriately in research.

That is, in each, the authors correctly laid out the key elements of the PPCT model, used methods that allowed them to assess those elements and the interactions among them, and then used their data to evaluate, critically, the theory itself. These authors, albeit implicitly, recognized that Bronfenbrenner's theory fits within the contextualist paradigm and treated it appropriately in their research.

Benson and Buehler (2012) wrote: “Ecological theory and the process-person-context-time (PPCT) model guided the hypotheses and analyses” (p. 1213), and that statement accurately sums up their study on influences on adolescent aggression over early to middle adolescence. Benson and Buehler (2012) were also explicit about the theory's emphasis on synergistic, not additive, effects, and they treated their hypotheses accordingly: “One hypothesis, following from the previous theory exemplars, asserts that family interaction and peer processes exert catalytic effects, such that combining similar influences exacerbates effects” (p. 1214). Each hypothesis, in fact, was linked to its theoretically derived source. In addition to family warmth and hostility (their measures of proximal processes), the authors included home, school, and peer group as the mesosystemic contexts of influence and various measures of person characteristics, with three waves of data gathering allowing for changes over time to be assessed.

Most helpful, from our perspective, Benson and Buehler (2012) took seriously their theoretical foundation while evaluating their results. For example:

A series of interaction findings show a pattern of peer deviance playing a nonadditive, synergistic role with family warmth, family hostility, and emotional distress. This pattern of nonadditive, synergistic processes is consistent with tenets of later formulations of ecological theory. (Benson & Buehler, 2012, p. 1223)

As the authors concluded, research using a “multicontext model and relies on all components of the PPCT model as shown in this study hold additional potential for advancing ecological theory (cf. Tudge et al., 2009) and effective interventions” (Benson & Buehler, 2012, p. 1224).

Farrant and Zubrick (2010) also made clear that they used a “bioecological approach” to study, over time, early vocabulary development and, citing Bronfenbrenner (1995), stated: “the effects of individual (e.g., parent) and environmental (context) effects are primarily indirect, mediated through their impact on proximal processes” (p. 343). Their hypotheses are thus in line with this theoretically driven presupposition:

Thus, this model predicts that being a girl, having a sociable temperament, an older, more educated, or warmer mother, or higher socio-economic status is associated with greater vocabulary development because these characteristics facilitate joint attention and parent–child book reading. (Farrant & Zubrick, 2010, pp. 346–347)

The study is highly effective in showing that the predicted mediator relations were largely found. Moreover, as we show in the concluding section, their analytic strategy, involving separate analyses for each relevant person characteristic and contextual factor involves one of the analytic strategies that Bronfenbrenner (1993, 1999; Bronfenbrenner & Morris, 1998, 2006) argued is necessary for appropriately applying an ecological or bioecological theory. This article thus well

qualifies as an appropriate use of the theory, particularly given the fact that the authors, in the discussion, used their data to reflect on the nature of the theory and to highlight the crucial role of proximal processes in early reading development.

Conclusions

Our goal in this theoretical review was to follow up Tudge et al.'s (2009) article in which the authors found that the majority of scholars who stated that they were using Bronfenbrenner's theory as the theoretical foundation of their work seemed to have either misrepresented the theory or, if accurately represented, to have misapplied it in their research. Our guiding question was, to what extent has the situation changed in the subsequent 6 years?

In some ways, the situation has improved. Tudge et al. (2009) found that 16 of the 25 articles they evaluated had referred only to Bronfenbrenner's theory from the 1970s or 1980s. Authors of a further five articles had cited the mature version of the theory (i.e., from 1993 on) but did not use it in their research, and just four articles were evaluated as having appropriately used the theory.

Of the 20 publications we reviewed for this article, just 2 referred only to the earlier versions of Bronfenbrenner's theory. This is a significant positive change, from 64% to 10%, since the analysis of Tudge et al. (2009). Of the remaining articles in the present review, six included citations to one or more of Bronfenbrenner's writings from the 1990s, but the authors did not refer to the PPCT model either in their discussion of the theory or as forming the basis for their research. In three publications the authors accurately described one or more of the important concepts, including proximal processes from the mature version of the theory but did not discuss these concepts in the context of the research. In seven studies, some or all of the PPCT concepts were both correctly described and included in the discussion of the research but without analysis of the various aspects of PPCT, either systemically or by considering how different levels of either person characteristics or context alter proximal processes. In some of these research reports it seemed as though the study variables were simply draped over the most relevant theoretical concepts rather than being treated as a means to evaluate the theory. Finally, in just 2 of the 20 published papers, the authors appropriately analyzed some or all parts of the PPCT model and also provided some critique, either of the results or of the theory itself. These authors, we believe, used Bronfenbrenner's theory as it should be used, by both testing and evaluating it. Only these authors appropriately treated the theory as fitting within the contextualist paradigm.

Overall, the present review suggests that many journal articles whose authors state that their research is based on Bronfenbrenner's theory neither accurately describe it in its mature form nor attempt to test it.² Our examination revealed that in some cases the theory was incorrectly presented (e.g., that Bronfenbrenner's theory is one of contextual influences on development) or treated as though there had been no significant conceptual changes as it developed from the 1970s to the 1990s, despite clear evidence to the contrary. Unlike the results of the Tudge et al. (2009) analysis, however, the vast majority of scholars drew on Bronfenbrenner's work from the 1990s on; the main problems were either failure to consider all aspects of the PPCT model or, if the model was correctly described, failure to analyze appropriately the synergistic relations

² O'Brien (2005) and Demo and Buehler (2013) provide supporting evidence.

among those aspects. Without taking seriously the synergy that is a defining characteristic of contextualist theories, there is a danger that a theory such as Bronfenbrenner's can be viewed as mechanistic, dealing with the separate effects on development of either context or of person characteristics.

As Tudge et al. (2009) pointed out, there may be some compelling reason for scholars to test an earlier version of a theory or specific concepts derived from an earlier version. However, a problem arises if no such reason is made explicit and readers are left thinking that what has been described as constituting the theory is what the theory currently is. More than 20 years since the first publication of the mature version of Bronfenbrenner's theory, scholars who cite only his work from the 1970s or 1980s as though the theory had not changed or cite the mature version of the theory but pay no attention to proximal processes and the other components of the PPCT model contribute to the misuse of theory and its continued treatment as though it fits within the mechanist paradigm.

In many cases, we found that some or all of the theory's main concepts were described, but the study variables were apparently draped onto whichever of the concepts seemed to be the best fit, without an attempt to test or evaluate the theoretically driven relations among the concepts. This "coat hanger" use of a theory seems more appropriate than one in which the theory itself is misrepresented, because the relevant concepts are mentioned. However, assessing the process aspect of PPCT requires more than just studying an interaction; person and context components have not been considered appropriately simply because people are being studied in one or other context; and merely because a study is longitudinal, it does not necessarily meet the time requirement.

A valid approach, by contrast, is one in which the methods and analyses are appropriate to the theory and in which the hypotheses to be tested are theoretically derived. This is not easy in the case of systemic (contextualist or relational developmental systems) theories but is essential if theories are to be tested and supported, refuted, or found to be in need of modification. Without such evaluation, theories will simply live on until, as Meehl (1978) wrote, "they fade away as people lose interest" (p. 806), but they will never support the development of our field.

Following Meehl (1978) and others (Demo & Buehler, 2013; Goldhaber, 2000; O'Brien, 2005; Thomas, 1997; Tudge, 2008), we think that it is important for the future of both family studies and developmental science that the theories we use in our research be subject to fair but critical evaluation. However, only 2 of the 20 published studies we reviewed were found to meet this goal, despite the fact that all the authors wrote that Bronfenbrenner's theory was serving as the theoretical foundation for their work. Why is this?

To understand this concern, we suggest thinking critically about social science research training in many graduate schools in which students are likely to have had classes in theory, methods, and statistics. Although there might well be some overlap between the latter two classes (e.g., considering the types of statistical analyses that are appropriate given one or another methodological approach), it seems much less likely that classes in theory are closely linked to the study of either methods or statistics. In our experience, moreover, although theses and dissertations are almost always required to have separate chapters on the work's theoretical

foundations and on the methods used, there seems to be little attempt to ensure tight consistency among the theory, methods, and statistical analyses, at least in those cases in which the theories fit in the organicist, contextualist, or developmental systemic paradigms. In addition, too rarely (in our experience) are doctoral students encouraged to test explicitly the theory that appeared in the first or second chapter of their dissertations. The situation is particularly problematic when secondary data sets are being used and when an original researcher's theoretical foundation differs from that which the students wish to use. In this case, the variables may simply not lend themselves to analysis as the theory requires.

From a pedagogical perspective, we call for explicit connections to be made between theories and their relevant methodological and statistical requirements. In other words, when teaching Bronfenbrenner's bioecological theory or any other contextualist or relational developmental theory, attention must be paid to the types of analyses that are necessary for testing it. Bronfenbrenner (1999) himself often saw a “critical difference” between analyses relevant to the bioecological model and other analytic designs:

By far the most common of these [other types of analyses] is the linear multiple regression model. This model provides estimates of the “independent” effect of each factor included in the research design.... As I have spelled out elsewhere, the multiple regression model, *as typically applied in psychological research*, requires the assumption that the various factors affecting the outcome operate *independently* of each other and that, therefore, their combined effects can be only *additive*. (Bronfenbrenner, 1999, p. 11, emphasis added; see also Bronfenbrenner, 1993; Bronfenbrenner & Morris 1998, 2006)

The first italicized phrase is, of course, important, and there are ways of using multiple regression that fit with the requirements of bioecological theory. Bronfenbrenner's (1993) problem with multiple regression was at least partially the widespread use of “treating potentially confounding factors [whether person characteristics or context] as covariates in a regression analysis” (p. 34). He argued, instead, that separate regression analyses should be run to assess whether the proximal processes under consideration were similar or different given the contexts and person characteristics under consideration.

A second statistical technique that could be taught alongside bioecological theory is structural equation modeling (SEM), given that this approach allows one to test multiple relations simultaneously. As Kline (2010) noted, “There is a sense in SEM that the view of the entire landscape (the whole model) has precedence over that of specific details (individual effects)” (p. 13). It is on the basis of the entire model that one makes a decision about whether the model should be accepted, modified, or rejected.

A third statistical approach that seems appropriate to these types of contextualist theories is the person-centered approach (Bergman, 1988; Magnusson, 1988). As Xie, Cairns, and Cairns (2001) wrote, having called for statistical analysis to match theoretical analysis: “The traditional variable-oriented approach which disentangles inter-related variables may not be sufficient. A person-oriented approach may be adopted to integrate multiple aspects of development and capture the coherent structure of individual functioning” (p. 489). As in Xie et al.'s (2001)

research, models can be tested that examine combinations of different individual factors, peer characteristics, and other aspects of the social context, such as family SES.

We therefore applaud the efforts of Benson and Buehler (2012) and Farrant and Zubrick (2012), who not only laid out the main concepts of bioecological theory but also derived hypotheses from those concepts, tested those hypotheses, and then critiqued the theory on the basis of their findings. Benson and Buehler (2012) used SEM in their analyses, and Farrant and Zubrick (2012) were careful to apply multiple regression analysis in a manner in keeping with Bronfenbrenner's requirements. As Farrant and Zubrick (2012) pointed out: "The proximal processes of joint attention and parent-child book reading were entered as mediators. A separate analysis was conducted for each individual or environmental characteristic" (p. 353). It is these types of analyses, appropriate to the synergistic nature of the theory, that need to be taught as an integral part of courses dealing with contextualist and systemic theories.

Finally, to the extent that graduate faculty and journal editors require researchers to make explicit their theoretical foundations, surely it should equally be a requirement for them not only to accurately describe the theoretically important concepts that guide their research but also to appropriately test one or more of them, to evaluate the theory in the light of their findings, and to be explicit about the paper's theoretically important limitations.

Abend, G. (2008). The meaning of theory. *Sociological Theory*, **26**, 173–199.
doi: [10.1111/j.1467-9558.2008.00324.x](https://doi.org/10.1111/j.1467-9558.2008.00324.x)

Ayón, C., Marsiglia, F. F., & Bermudez-Parsai, M. (2010). Latino family mental health: Exploring the role of discrimination and familismo. *Journal of Community Psychology*, **38**, 742–756. doi: [10.1002/jcop.20392](https://doi.org/10.1002/jcop.20392)

Baker, C. E., & Iruka, I. U. (2013). Maternal psychological functioning and children's school readiness: The mediating role of home environments for African American children. *Early Childhood Research Quarterly*, **28**, 509–519.
doi: [10.1016/j.ecresq.2013.02.004](https://doi.org/10.1016/j.ecresq.2013.02.004)

Behnke, A. O., Plunkett, S. W., Sands, T., & Bámaca-Colbert, M. Y. (2011). The relationship between Latino adolescents' perceptions of discrimination, neighborhood risk, and parenting on self-esteem and depressive symptoms. *Journal of Cross-Cultural Psychology*, **42**, 1179–1197. doi: [10.1177/0022022110383424](https://doi.org/10.1177/0022022110383424)

Benson, M. J., & Buehler, C. (2012). Family process and peer deviance influences on adolescent aggression: Longitudinal effects across early and middle adolescence. *Child Development*, **83**, 1213–1228. doi: [10.1111/j.1467-8624.2012.01763.x](https://doi.org/10.1111/j.1467-8624.2012.01763.x)

Bergman, L. R. (1988). You can't classify all of the people all of the time. *Multivariate Behavioral Research*, **23**, 425–441. http://dx.doi.org/10.1207/s15327906mbr2304_1

Bornstein, M. H. (2009). Toward a model of culture-parent-child transactions. In A. Sameroff (Ed.), *The transactional model of development: How children and contexts shape each other* (pp. 139–161). Washington, DC: American Psychological Association.

- Bowen, A., Moring, J., Williams, M., Hopper, G., & Daniel, C. (2012). An investigation of bioecological influences associated with first use of methamphetamine in a rural state. *Journal of Rural Health*, **28**, 286– 295. doi: [10.1111/j.1748-0361.2011.00391.x](https://doi.org/10.1111/j.1748-0361.2011.00391.x)
- Boxer, P., Huesmann, L. R., Dubow, E. F., Landau, S. F., Gvirsman, S. D., Shikaki, K., & Ginges, J. (2013). Exposure to violence across the social ecosystem and the development of aggression: A test of ecological theory in the Israeli–Palestinian conflict. *Child Development*, **84**, 163– 177. doi: [10.1111/j.1467-8624.2012.01848.x](https://doi.org/10.1111/j.1467-8624.2012.01848.x)
- Bronfenbrenner, U. (1958). Socialization and social class through time and space. In E. E. Maccoby, T. M. Newcomb, & E. L. Hartley (Eds.), *Readings in social psychology* (3rd ed., pp. 400– 424). New York, NY: Holt, Rinehart and Winston.
- Bronfenbrenner, U. (1975). Reality and research in the ecology of human development. *Proceedings of the American Philosophical Society*, **119**, 439– 469.
- Bronfenbrenner, U. (1976). The experimental ecology of education. *Teachers College Record*, **78**, 157– 204.
- Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, **32**(7), 513– 531.
- Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U. (1994). Ecological models of human development. In T. Husen & T. N. Postlethwaite (Eds.), *International encyclopedia of education* (2nd ed., Vol. **3**, pp. 1643– 1647). Oxford, UK: Pergamon Press.
- Bronfenbrenner, U. (1995). Developmental ecology through space and time: A future perspective. In P. Moen, G. H. Elder, & K. Lüscher (Eds.), *Examining lives in context: Perspectives on the ecology of human development* (pp. 619– 647). Washington, DC: American Psychological Association.
- Bronfenbrenner, U. (1999). Environments in developmental perspective: Theoretical and operational models. In S. L. Friedman & T. D. Wachs (Eds.), *Measuring environment across the life span: Emerging methods and concepts* (pp. 3– 28). Washington, DC: American Psychological Association Press.
- Bronfenbrenner, U. (2000). Ecological systems theory. In A. Kazdin (Ed.), *Encyclopaedia of psychology* (Vol. **3**, pp. 129– 133). Washington, DC: American Psychological Association.
- Bronfenbrenner, U. (2001). The bioecological theory of human development. In N. J. Smelser & P. B. Baltes (Eds.), *International encyclopedia of the social and behavioral sciences* (Vol. **10**, pp. 6963– 6970). New York, NY: Elsevier.
- Bronfenbrenner, U. (2005). *Making human beings human: Bioecological perspectives on human development*. Thousand Oaks, CA: Sage.

- Bronfenbrenner, U., & Ceci, S. J. (1993). Heredity, environment, and the question “how?”: A first approximation. In R. Plomin & G. G. McClearn (Eds.), *Nature, nurture, and psychology* (pp. 313– 323). Washington, DC: American Psychological Association.
- Bronfenbrenner, U., & Ceci, S. (1994). Nature–nurture reconceptualized in developmental perspective: A bioecological model. *Psychological Review*, **101**, 568– 586. doi: [10.1037/0033-295X.101.4.568](https://doi.org/10.1037/0033-295X.101.4.568)
- Bronfenbrenner, U., & Evans, G. W. (2000). Developmental science in the 21st century: Emerging questions, theoretical models, research designs and empirical findings. *Social Development*, **9**, 115– 125. doi: [10.1111/1467-9507.00114](https://doi.org/10.1111/1467-9507.00114)
- Bronfenbrenner, U., & Morris, P. A. (1998). The ecology of developmental processes. In W. Damon (Series Ed.) & R. M. Lerner (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development (5th ed., pp. 993–1028)*. New York, NY: Wiley.
- Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. In W. Damon & R. M. Lerner (Series Eds.) & R. M. Lerner (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development (6th ed., pp. 793–828)*. New York, NY: Wiley.
- Chien, N. C., & Mistry, R. S. (2013). Geographic variations in cost of living: Associations with family and child well-being. *Child Development*, **84**, 209– 225. doi: [10.1111/j.1467-8624.2012.01846.x](https://doi.org/10.1111/j.1467-8624.2012.01846.x)
- Demo, D. H., & Buehler, C. (2013). Theoretical approaches to studying divorce. In M. A. Fine & F. D. Fincham (Eds.), *Handbook of family theories: A content-based approach* (pp. 263– 279). New York, NY: Routledge.
- Drillien, C. M. (1964). *Growth and development of the prematurely born infant*. Edinburgh, UK: E. & S. Livingston.
- Elder, G. H., Jr. (1974). *Children of the great depression*. Chicago, IL: University of Chicago Press.
- Epstein, J. L. (2001). *School and family partnerships: Preparing educators and improving schools*. Boulder, CO: Westwood Press.
- Farrant, B. M., & Zubrick, S. R. (2012). Early vocabulary development: The importance of joint attention and parent–child book reading. *First Language*, **32**, 343– 364. doi: [10.1177/0142723711422626](https://doi.org/10.1177/0142723711422626)
- Galindo, C., & Sheldon, S. B. (2012). School and home connections and children's kindergarten achievement gains: The mediating role of family involvement. *Early Childhood Research Quarterly*, **27**, 90– 103. doi: [10.1016/j.ecresq.2011.05.004](https://doi.org/10.1016/j.ecresq.2011.05.004)
- Goldhaber, D. E. (2000). *Theories of human development: Integrative perspectives*. Mountain View, CA: Mayfield.
- Grogan-Kaylor, A., & Woolley, M. E. (2010). The social ecology of race and ethnicity school achievement gaps: Economic, neighborhood, school, and family factors. *Journal of*

Human Behavior in the Social Environment, **20**, 875– 896.
doi: [10.1080/10911359.2010.494927](https://doi.org/10.1080/10911359.2010.494927)

- Hemar-Nicolas, V., Ezan, P., Gollety, M., Guichard, N., & Leroy, J. (2013). How do children learn eating practices? Beyond the nutritional information, the importance of social eating. *Young Consumers*, *14*, 5–18. doi: <http://dx.doi.org/10.1108/17473611311305458>
- Hendricks, C., Lansford, J. E., Deater-Deckard, K., & Bornstein, M. H. (2014). Associations between child disabilities and caregiver discipline and violence in low- and middle-income countries. *Child Development*, *85*, 513– 531. doi: 0.1111/cdev.12132
- Kline, R. B. (2010). *Principles and practice of structural equation modeling* (3rd ed.). New York, NY: Guilford Press.
- Leonard, J. (2011). Using Bronfenbrenner's ecological theory to understand community partnerships: A historical case study of one urban high school. *Urban Education*, *46*, 987– 1010. doi: [10.1177/0042085911400337](https://doi.org/10.1177/0042085911400337)
- Lerner, R. M. (2015). Promoting positive human development and human justice: Integrating theory, research, and application in contemporary developmental science. *International Journal of Psychology*, *50*, 165– 173. doi: [10.1002/ijop.12162](https://doi.org/10.1002/ijop.12162)
- Lerner, R. M., Johnson, S. K., & Buckingham, M. H. (2015). Relational developmental systems-based theories and the study of children and families: Lerner and Spanier (1978) revisited. *Journal of Family Theory & Review*, *7*, 83– 104. doi: [10.1111/jftr.12067](https://doi.org/10.1111/jftr.12067)
- Lerner, R. M., & Overton, W. F. (2008). Exemplifying the integrations of the relational developmental system: Synthesizing theory, research, and application to promote positive development and social justice. *Journal of Adolescent Research*, *23*, 245– 255. doi: [10.1177/0743558408314385](https://doi.org/10.1177/0743558408314385)
- MacNeil, T. A., & Adamsons, K. (2014). A bioecological view of interracial/same-race couple conflict. *International Journal of Conflict Management*, *25*, 243– 260. doi: [10.1108/IJCM-08-2012-0063](https://doi.org/10.1108/IJCM-08-2012-0063)
- Magnusson, D. (1988). *Individual development in paths through life: Vol. 1. A longitudinal study*. Hillsdale, NJ: Erlbaum.
- Maynard, B. R., Beaver, K. M., Vaughn, M. G., DeLisi, M., & Roberts, G. (2014). Toward a bioecological model of school engagement: A biometric analysis of gene and environmental factors. *Social Work Research*, *38*, 164– 176. doi: [10.1093/swr/svu018](https://doi.org/10.1093/swr/svu018)
- Meehl, P. E. (1978). Theoretical risks and tabular asterisks: Sir Karl, Sir Ronald, and the slow progress of soft psychology. *Journal of Consulting and Clinical Psychology*, *46*(4), 806– 834.
- Mistry, J., Contreras, M., & Dutta, R. (2012). Culture and child development. In I. B. Weiner (Series Ed.) & R. M Lerner, M. A. Easterbrooks, & J. Mistry (Vol. Eds.), *Comprehensive handbook of psychology: Vol. 6. Developmental psychology* (pp. 265–285). Hoboken, NJ: Wiley.

- Mistry, J., & Dutta, R. (2015). Human development and culture: Conceptual and methodological issues. In W. F. Overton & P. C. Molenaar (Eds.), *Handbook of child psychology and developmental science: Theory and method* (7th Ed., Vol. 1, pp. 369– 406). Hoboken, NJ: Wiley.
- Nobre, F. S. S., Coutinho, M. T. C., & Valentini, N. C. (2014). The ecology of motor development in coastal school children of Brazil Northeast. *Journal of Human Growth and Development*, **24**, 263– 273. doi: [10.7322/jhdg.88910](https://doi.org/10.7322/jhdg.88910)
- O'Brien, M. (2005). Studying individual and family development: Linking theory and research. *Journal of Marriage and Family*, **67**, 880– 890. doi: [10.1111/j.1741-3737.2005.00181.x](https://doi.org/10.1111/j.1741-3737.2005.00181.x)
- Ochoa, D. P. (2014). Parental socialization of moral behaviors in the context of poverty. *Philippine Journal of Psychology*, **47**(1), 41– 72.
- Overton, W. F. (1984). World-views and their influence on psychological theory and research: Kuhn–Lakatos–Laudan. In H. W. Reese (Ed.), *Advances in child development and behavior* (Vol. 18, pp. 191– 226). New York, NY: Academic Press.
- Overton, W. F. (2007). A coherent metatheory for developmental systems: Relational organicism-contextualism. *Human Development*, **50**, 154– 159. doi [10.1159/000100944](https://doi.org/10.1159/000100944)
- Overton, W. F. (2013). Relationism and relational developmental systems: A paradigm for developmental science in the post-Cartesian era. *Advances in Child Development and Behavior*, **44**, 21– 64.
- Overton, W. F. (2015). Process and relational developmental systems. In W. F. Overton & P. C. Molenaar (Eds.), *Handbook of child psychology and developmental science: Theory and method* (7th Ed., Vol. 1, pp. 9– 62). Hoboken, NJ: Wiley.
- Overton, W. F., & Ennis, M. D. (2006). Cognitive-developmental and behavior-analytic theories: Evolving into complementarity. *Human Development*, **49**, 143– 172. doi [10.1159/000091893](https://doi.org/10.1159/000091893)
- Overton, W. F., & Lerner, R. M. (2012). Relational developmental systems: A paradigm for developmental science in the postgenomic era. *Behavior and Brain Science*, **35**, 375– 376. doi: [10.1017/S0140525X12001082](https://doi.org/10.1017/S0140525X12001082)
- Overton, W. F., & Reese, H. W. (1973). Models of development: Methodological implications. In J. R. Nesselroade & H. W. Reese (Eds.), *Lifespan developmental psychology: Methodological issues* (pp. 65– 86). New York, NY: Academic Press.
- Pepper, S. C. (1942). *World hypotheses: A study in evidence*. Berkeley, CA: University of California Press.
- Poehlmann, J., Schwichtenberg, A. J. M., Bolt, D. M., Hane, A., Burnson, C., & Winters, J. (2011). Infant physiological regulation and maternal risks as predictors of dyadic interaction trajectories in families with a preterm infant. *Developmental Psychology*, **47**, 91– 105. doi: [10.1037/a0020719](https://doi.org/10.1037/a0020719)

- Reese, H. W., & Overton, W. F. (1970). Models of development and theories of development. In L. R. Goulet & P. B. Baltes (Eds.), *Life-span developmental psychology: Research* (pp. 115– 145). New York, NY: Academic Press.
- Rosa, E. M., & Tudge, J. R. H. (2013). Urie Bronfenbrenner's theory of human development: Its evolution from ecology to bioecology. *Journal of Family Theory & Review*, **5**, 243– 258. doi: [10.1111/jftr.12022](https://doi.org/10.1111/jftr.12022)
- Sameroff, A. J. (1994). Developmental systems and family functioning. In R. G. Parke & S. G. Kellam (Eds.), *Exploring family relationships with other social contexts* (pp. 199– 214). Hillsdale, NJ: Erlbaum.
- Sameroff, A. J., & Fiese, B. (2000). Models of development and developmental risk. In C. H. Zeannah (Ed.), *Handbook of infant mental health* (2nd ed., pp. 3– 19). New York, NY: Guilford Press.
- Thomas, G. (1997). What's the use of theory? *Harvard Educational Review*, **67**(1), 75– 104. doi:10.17763/haer.67.1.1x807532771w5u48
- Tudge, J. R. H. (2008). *The everyday lives of young children: Culture, class, and child rearing in diverse societies*. New York, NY: Cambridge University Press.
- Tudge, J. R. H. (2013). Urie Bronfenbrenner. In Heather Montgomery (Ed.), *Oxford bibliographies on line: Childhood studies*. New York, NY: Oxford University Press. doi: [10.1093/OBO/9780199791231-0112](https://doi.org/10.1093/OBO/9780199791231-0112)
- Tudge, J. R. H., Mokrova, I., Hatfield, B., & Karnik, R. B. (2009). Uses and misuses of Bronfenbrenner's bioecological theory of human development. *Journal of Family Theory & Review*, **1**, 198– 210. doi: [10.1111/j.1756-2589.2009.00026.x](https://doi.org/10.1111/j.1756-2589.2009.00026.x)
- Votruba-Drzal, E., Coley, R. L., Maldonado-Carreño, C., Li-Grining, C. P., & Chase-Lansdale, P. L. (2010). Child care and the development of behavior problems among economically disadvantaged children in middle childhood. *Child Development*, **81**, 1460– 1474. doi: [10.1111/j.1467-8624.2010.01485.x](https://doi.org/10.1111/j.1467-8624.2010.01485.x)
- Williams, J., & Nelson-Gardell, D. (2012). Predicting resilience in sexually abused adolescents. *Child Abuse & Neglect*, **36**, 53– 63. doi: [10.1016/j.chiabu.2011.07.004](https://doi.org/10.1016/j.chiabu.2011.07.004)
- Xie, H., Cairns, B. D., & Cairns, R. B. (2001). Predicting teen motherhood and teen fatherhood: Individual characteristics and peer affiliations. *Social Development*, **10**(4), 488– 511. doi:10.1111/1467-9507.00177