Commentary

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Complexity Embraced and Complexity Reduced: A Tale of Two Approaches to Human Development

Commentary on Witherington and Lickliter

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The world is complex. So too is human development. I know of no scientist, within or outside the field of developmental science, who would dispute these obvious points. Differences among scientists exist, however, in regard to how complexity is treated.

At this writing, there are two prominent approaches to treating the complexity of human development. One approach embraces it, including complexity as a defining feature of the developmental process. As explained with nuance, insight, and eloquence by Witherington and Lickliter [this issue, pp. 200–234], the other approach reduces the complexity of development to changes that merely express, or that fail to express, information that exists prior to a given organism even being conceived.

The latter approach is an essentialist formulation.[1] Complexity is in essence explained away through ideas that reduce higher (and more complex) levels of organization to a fundamental level (in this case, a gene). The essentialist proposal is that the to-be-reduced-to element comprises the unit of analysis existing at the fundamental or ultimate level of analysis (i.e., the one that explains development). Examples of such formulations in developmental science are the stimulus-response (*S*-*R*) connections to which complex human behavior (e.g., cognitive development, lan-

[1] Essentialism may be defined as a doctrine holding that there are necessary properties of things and that these properties are logically prior to the existence of the individuals which instantiate them; as the doctrine that essence is prior to existence; and/or as the practice of regarding something as having innate existence.

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guage development, moral development) was said to be able to be reduced [e.g., Bijou & Baer, 1961; Skinner, 1971], fixed action patterns (FAPs) [Lorenz, 1965], genes per se [e.g., Belsky, 2014; Plomin, Defries, Knopik, & Neiderhiser, 2016; Rimfeld, Ayorech, Dale, Kovas, & Plomin, 2016; Rushton, 2000], or constructions termed "evolved probabilistic cognitive mechanisms" (EPCMs) that are said to reside in genes by proponents of evolutionary developmental psychology (EDP) [e.g., Bjorklund, 2015; Bjorklund & Ellis, 2005; del Giudice & Ellis, 2016].

As explained by Witherington and Lickliter [2016], the argument of EDP proponents has been that these entities control the parameters of the higher levels of organization. The role in human development of these higher levels is only to manage the expression or release of the information contained in the essential level. In short, in the essentialist approach there is a Cartesian-like split between the ultimate cause of development – pre-organism-existing information, shaped by evolution (phylogeny) and inserted into the organism at conception through the content of a gene – and the instantiation of the information, which depends on the vicissitudes of everyday life, the ebb and flow of relations between the organism, and its context across ontogeny [Witherington & Lickliter, 2016].

In turn, however, in the approach that embraces complexity (and does not reduce it to an essentialist entity), the process of development itself is the source of structure and function of the organism; there is no preexisting information split off from the developmental process and no essential level of organization to which complex higher levels are to be reduced [Witherington & Lickliter, 2016]. As explained by Witherington and Lickliter, this approach is associated with a relational developmental systems (RDS) metatheory, which is derived from what Overton [2015] terms a process-relational paradigm.

Overton [2015] explains that, compared to a Cartesian worldview, the process-relational paradigm focuses on process (systematic changes in the developmental system), becoming (moving from potential to actuality; a developmental process as having a past, present, and future [Whitehead, 1929/1978]), holism (the meanings of entities and events derive from the context in which they are embedded), relational analysis (assessment of the mutually influential relations within the developmental system), and the use of multiple perspectives and explanatory forms (employment of ideas from multiple theory-based models of change within and of the developmental system) in understanding human development. Within the process-relational paradigm, the organism is seen as inherently active, self-creating (autopoietic), self-organizing, self-regulating (agentic), adaptive, and nonlinear/complex [Overton, 2015; see also Sokol, Hammond, Kuebli, & Sweetman, 2015].

In turn, within the RDS approach to theory, split conceptions are eschewed in favor of a metatheoretical emphasis on the study *and integration* of different levels of organization, ranging from biology/physiology to culture and history, as a means to understand life span human development [Lerner, 2006, 2012, 2015; Overton, 2013, 2015]. Accordingly, the conceptual emphasis in RDS theories is placed on mutually influential relations between individuals and contexts across ontogeny, represented as individual ↔ context relations.

Witherington and Lickliter emphasize that the concept of emergence is of fundamental importance in understanding the RDS approach and its difference with essentialist approaches, such as EDP [e.g., Bjorklund, 2015; Bjorklund & Ellis, 2005; del Giudice & Ellis, 2016). I agree. Specifically, a fundamental idea in the EDP approach

is that there are entities, EPCMs, that exist before the organism and frame its development (with ontogeny just determining what is placed within the frame – much like a building contractor frames one's house but the owners of the house fill in the frame by acting to select paint colors, appliances, floor coverings, etc.). In contrast, and as also emphasized by Witherington and Lickliter [2016; see also Lickliter & Honeycutt, 2015; Mascolo, 2013; Overton, 2015; van Geert & Fischer, 2009; Witherington, 2011, 2015], Raeff [2016, pp. 12–13] explains that in the RDS-based view:

> Behavior emerges out of interrelations among "ongoing processes intrinsic to the system" [Lewis, 2000, p. 38]. Claiming that human functioning emerges through interrelations among intrinsic constituent processes means that one does not have to involve external, antecedent, or independent factors to explain what people do. In addition, the concept of emergence stands in explicit contrast to any conceptualization of behavior and development as predesigned or predestined by, for example, genetics or how the brain is "hardwired." Rather, what a person does emerges, or is always coming into being, through the ongoing dynamics of constituent processes.

In short, at this writing developmental science includes two very different approaches to the complexity of the integrated, multilevel, interrelated changes that everyone within the field agrees characterize human ontogeny. What are we to make of these two approaches? Are both useful frames for the study of human development? If so, then how should research proceed? If not, why? And again, how should research about human development proceed?

A Tale of the Two Approaches

Given the features of the essentialist and the RDS approaches that Witherington and Lickliter [2016] explain in careful detail and that I have summarized, a key question must be addressed in evaluating their respective usefulness: are the characteristics of an individual (a) features deriving from the constituent processes of the developmental system or are they (b) an outcome of the developmental system acting on something that preexists and that merely awaits expression, should the organism happen to grow up in an environment "typical" of its species? From an EDP perspective, del Giudice and Ellis [2016] contend that "while [sic] evolved mechanisms prepare an organism for life in a species-typical environment, they are not preformed or specified in advance by a rigid genetic program" (p. 7).

But where do these "mechanisms" exist and in what form? From an essentialist perspective, they must exist prior to the existence of the organism that houses them during its ontogeny. Presumably these mechanisms *must* be located in the gametes of parents. But how did the information or process constituted by these "mechanisms" come to reside in the gametes? This information or material – or whatever it is – must have come through the germ line of the parents' parents (so we are now going to the grandparental generation for an answer to the question of the origin of the EPCMs in the development of a given, "target" individual). But the same question continues to be needed to be asked of this grandparent generation, of the one prior to it, and so on through an infinite regress that keeps the question being pushed further back in history without any definitive empirical verification. Because of this infinite regress, EDP sets up an argument that cannot be falsified by any developmental data pertinent to a target individual's life span, because there always has to be an appeal made to a former generation as the source of the "whatever."

Moreover, the idea of this whatever – for the purposes of illustration let me label is, say, a homunculus – can only pertain to something that could actually exist *if* genes and context are split entities and, as such, if genes were then conceived of as entities that contained the homunculus, *and*, as well, if modern work in biology pertaining to epigenetics was irrelevant [e.g., Lester, Conradt, & Marsit, 2016; Meaney, 2010; Moore, 2015]. Of course, in such a formulation, the homunculus could only be released if the gene was turned on sufficiently, and here proponents of EDP claim that, for such an occurrence, for the homunculus to be instantiated, the "correct" context, a species-typical one, needs to be present for at least some (unspecified) portion of ontogeny [e.g., again, see del Giudice & Ellis, 2016, p. 7].

But here lie problems of circularity of reasoning becoming coupled with an argument already fatally flawed by the use of the unfalsifiable postulation of an infinite regress: if one sees the homunculus, then it *must* be the case that there was a species-typical environment, because there would be no other way for the homunculus to appear. And if one does not see the homunculus, then it *must* be that it is absent because there was not a species-typical environment within which the organism developed. Ironically, the postulation of the existence of this prior-to-being homunculus cannot be falsified by any direct empirical evidence pertinent to the purported evolutionary (phylogenetic) history that created it. Phylogeny is not studied and, instead, reference is made to an unassessed ontogenetic history that is inferred to have existed because of the presence or absence of some behaviors that are claimed to reflect the also-never-assessed evolutionary history. Indeed, it is ironic that the only recourse proponents of EDP have to prove their phylogenetic case is to appeal to an ontogenetic developmental process that is regarded by them to have no ultimate causal efficacy, but only the capacity to facilitate the expression of an entity caused by a phylogenetic process! The morass of logical problems and appeals to impossible-to-document histories makes the cornerstone idea of EDP – EPCMs – as useful a scientific concept as is the homunculus label I have applied to it.

Importantly, developmental science has been subjected to these problematic formulations before the advent of EDP. That is, the logical and empirical shortcomings of the EDP concept of EPCMs are comparable to the fatal flaws associated with the other formulations of essentialist thinking in developmental science that I noted earlier in this article. All of these formulations become counterfactual because of not being able to marshal the empirical evidence that is needed to support their claims about scientific usefulness.

For instance, for the nurture reductionism of Skinner [e.g., 1971] to work as a comprehensive explanation of the behavior of organisms [Skinner, 1938], there must be an *S* for every *R*. However, as pointed out by Bowers [1973], one of the key reasons that Skinner's approach fails is the problem of the missing *S*. Simply, research has failed to identify an *S* (i.e., a discriminative stimulus, which has the status of a secondary reinforcing stimulus) for every *R* that exists. Yet, such an *S* is stipulated by Skinner to be needed to elicit operant behavior. If such stimuli are *the* cause of operant behavior in any given situation, then how can empiricists hold that the *S*-*R* formulation (S^D-R-S^R) is useful when there are so many *R*s for which there are no *S*s to be seen? They cannot. As such, the radical behaviorism of Skinner [e.g., 1938, 1971] is reduced to a view that must be accepted on the basis of faith (that there must have been an *S* somewhere) and not on empirical evidence.

The concept of the FAP formulated by Lorenz [1937a, b, 1965] is an example of a nature essentialist formulation, one which is similar to the EPCMs postulated by proponents of EDP [e.g., Bjorklund, 2015; Bjorklund & Ellis, 2005; del Giudice & Ellis, 2016]. Oddly, these EDP proponents are either unaware of this similarity or have elected to not note it because of the several logical and empirical problems with Lorenz's concept or, perhaps as well, because of Lorenz's own history of problems with his use of nativist ideas [e.g., see Lerner, 1992]. In any case, Lorenz [1937a, b, 1965] used the FAP to illustrate his concept of instinct, which he claimed was a behavior that could be observed when the individual experienced a specific "releasing" stimulus – that is, when the organism encountered a certain stimulus that "triggered" a given instinct. Lorenz posited the existence of an "innate releasing mechanism," a hypothetical mechanism believed to involve a set of receptor cells that released the instinctual behavior pattern when activated by a specific environmental stimulus.

According to Lorenz [1937a, 1965], experience over the course of an organism's life (its ontogeny) had no role in the shaping of the development of a presumed neural structure that enabled the innate releasing mechanism to occur. Instead the key, innate feature of such a neural structure was "its ability to select, from the range of available possible stimuli, the one which specifically elicits its activity, and thus the response seen by the observer" [Lehrman, 1970, p. 24]. The response to the innate structure was an FAP.

The classic example of an FAP involves the male three-spined stickleback fish [Lorenz, 1965]. When this fish encounters another male three-spined stickleback with a red belly, the fish displays a set of behaviors indicative of threat. In contrast, when the fish encounters a female with a swollen (but not red) belly, the male displays the behavior pattern indicative of mating.

However, a problem with the foundational argument and definition of the FAP exists. Lorenz admitted that if the appropriate releasing stimulus was not encountered for some period of time, then the FAP could occur spontaneously. That is, it "might go off in vacuo, as if dammed energy burst through containing valves" [Richards, 1987, p. 531].

It seemed obvious to Lorenz [1965] that the FAP with the three-spined sticklebacks was a behavior clearly shaped by evolution, given what he saw as the importance of the threat or mating displays by the male fish for, respectively, warding off competitors for female fish and for engagement with a possible mate if a competitor for the mate swam away in the face of the FAP. However, the problematic facet of this and other examples of FAPs [Lehrman, 1970; Richards, 1987], which in effect might be termed an evolved probabilistic *behavioral* mechanism (EPBM), is the spontaneous enactment of the behavior. This spontaneous behavior would occur with no evolutionary-relevant stimulus (a male or a female conspecific) in view to engage the purported innate neural structure housing the innate releasing mechanism. Thus, the purported phylogenetic antecedent that explained the EPBM only explained it in some cases, at some times, in some contexts.

Similarly, proponents of EDP can only say that if the EPCM occurs normatively, then the context was species typical; if the EPCM is not expressed normatively, then this manifestation of behavior is taken as proof for the existence of a context (and typically a *never measured* context) that was atypical. Like Skinner [e.g., 1971], in regard to the postulation that a relevant (releasing) *S* must have been present if one saw an *R* [Bowers, 1973], the outcome in the formulation of EDP, the appearance (or lack

thereof) of the EPCM, explains the antecedent that purportedly explains the outcome!

Thus, the ideas of the proponents of EDP [e.g., Bjorklund, 2015; Bjorklund & Ellis, 2005; del Giudice and Ellis, 2016] converge with those involved in other essentialist formulations. Whether we are talking about EPCMs or EPBMs, we run into the same problem: one cannot identify these essentialist "mechanisms" independently of their ontogenetic emergence or their subsequent display in ontogeny after their emergence. We cannot say that these homunculi, EPCMs, EPBMs, FAPs, or whatevers, are always there, independently of context, because the context instantiates them (or does not instantiate them as the case may be). However, the instantiation by the context will be different under different environmental conditions (e.g., species typical vs. atypical, or red underbelly present vs. red underbelly absent), and therefore the whatever (e.g., the homunculus or the EPCM) cannot be known to exist in any form without the context.

In short, there is no way of knowing the purported evolutionary-based "whatever" independently of the ontogenetic context! Simply, then, and at best, the foundational concept of EDP (the EPCM), the essentialist approach to the complexity of human development, is entirely nonempirical and gratuitous. At worst, it is so fraught with logical, conceptual, and empirical problems that using it as a basis for research in human development is a scholarly dead end. The objections that proponents of EDP (and proponents of the related evo-devo approach [e.g., Gilbert, 2003]) have to RDS-based approaches to the complexity of human development reflect at best a lack of understanding of the dynamics of developmental systems [e.g., see Raeff, 2016, and Witherington & Lickliter, 2016]. Whatever the basis of the objections of proponents of EDP, however, their views have resulted in their invention of the equivalent of a homunculus to explain the autopoietic features of a dynamic developmental system.

Conclusions

Developmental science may be at a crossroad. Given the irreparable logical and empirical shortcomings of essentialist approaches to human development, there is no scientific value in the continued theoretical or empirical use of these ideas, whether we are discussing past instantiations of them, such as those forwarded by Skinner [1971] or Lorenz [1965], or examples of them present in the essentialist and reductionist literatures at the time of this writing, for instance, EDP [e.g., Bjorklund, 2015; del Giudice & Ellis, 2016], sociobiological neo-eugenics [e.g., Belsky, 2014], or behavior genetics [e.g., Plomin et al., 2016]. Focusing on these flawed ideas as a basis for research or as a means to formulate applications to social policies or programs is a waste of valuable scholarly resources and has the potential to foster applications of developmental science that are derived from seriously mistaken ideas [Lerner, 2015].

Developmental scientists enacting many of the roles associated with our work – for example, faculty members participating in hiring, tenure, and promotion decisions, teachers, mentors, peer reviewers, editors, and of course researchers – are faced, then, with a decision. Do we embrace the complexity of human development in the enactment of all of our roles and, as such, articulate that essentialist approaches are no longer acceptable frames for the conduct of developmental science (e.g., as

we would if we were faced with evaluating work that used phrenology as the frame for our scholarship), or do we allow egregiously flawed thinking and associated work to fill the minds of our students and the pages of our journals (in the name, perhaps, of academic freedom)?

I articulate the dimensions of this decision with more than a little trepidation, given the range of responses I expect it will elicit. However, more than the quality of our science is at stake. Developmental scientists should also recognize that civil society may hang in the balance, given the repeated applications of essentialist thinking finding its way into public policy discourse in the USA and internationally at this writing, for instance, regarding political nativist ideas about racial, ethnic, and religious diversity and about immigration and immigrants. The quality of life and the welfare of millions of people may be affected by where developmental scientists stand in regard to these issues and what they may be willing to say publicly about them.

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