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## Evolutionary Developmental Psychology: 2017 Redux

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Bjorklund is a pioneer in bringing evolutionary theory to developmental psychology. In doing so, he has made major contributions to the field, including publishing a widely adopted and influential textbook (Bjorklund & Causey, 2017). We commend him for his groundbreaking research and strongly agree that it is “undeniable that evolutionary thinking has seeped into the minds of many cognitive developmental psychologists” (Bjorklund, 2018, p. 14).

We suggest that evolutionary theory has impacted developmental psychology even more strongly than Bjorklund suggests. Many of the most influential recent programs of research in the field of developmental psychology, cognitive and otherwise, take an evolutionary approach to understanding the ontogeny of cognition and behavior (as just a few recent examples: Barrett et al., 2013; Blake et al., 2015; Broesch, Rochat, Olah, Broesch, & Henrich, 2016; Clay & Tennie, 2017; Gopnik et al., 2017; Hamlin, 2014; Henrich, 2015a; Heyes, in press; House et al., 2013; Nielsen & Haun, 2016; Rosati & Warneken, 2016; Santos & Rosati, 2015; van Leeuwen, Call, & Haun, 2014; Warneken & Tomasello, 2017; Wertz & Wynn, 2014). Additional evidence of impact can be found in recent programs at major conferences in the field. The Society for Research in Child Development, the Cognitive Development Society, and the International Congress for Infant

Studies have all featured evolutionary research in preconferences and invited addresses in recent years. In fact, evolution has been so successful as a metatheory within developmental psychology, many doing research within this tradition do not use this label to identify their area of expertise or theoretical approach.

Perhaps as a result of developmental psychologists conducting research that is increasingly guided by evolutionary theory, but not explicitly labeled as such, there is a large body of recent literature not reviewed by Bjorklund. To give one example, the best research on cognitive obstacles to understanding evolution and recommendations for how to teach it comes from research programs in cognitive and developmental psychology that draw on evolutionary theory. This research demonstrates that intuitive cognitive bias such as essentialism and teleological reasoning impede understanding of evolutionary concepts (e.g., Emmons, Smith, & Kelemen, 2016; Evans, in press; Heddy & Sinatra, 2013; Legare, Lane, & Evans, 2013; Lombrozo, 2013; Short & Hawley, 2015; Shtulman, Neal, & Lindquist, 2016).

Another increasingly influential trend within developmental, cognitive, and comparative research guided by evolutionary theory, not covered in Bjorklund’s review, is to examine the origins of complexity and variability in human culture. Tackling interdisciplinary questions of this kind requires understanding the differences between human and

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nonhuman social learning capacities, the ontogeny of those capacities, and their expression across diverse human populations. We propose that only the combination of these perspectives will enable us to fully understand the roots of human culture. We and others advocate for a triadic approach to understanding the evolution and ontogeny of cultural learning by integrating comparative, cross-cultural, and developmental psychological research, with all of these lines drawing heavily on evolutionary theory (Legare, 2017; Nielsen & Haun, 2016).

Our research differs from Bjorklund's not because we disagree about the importance and impact of evolutionary theory within developmental psychology, but instead is based on the relative emphasis we place on the scientific importance of understanding cultural transmission and variation. Examining cultural variation would enrich Bjorklund's discussion of developmental cognitive neuroscience and cognitive development. Claims about the universality and ontogeny of cognitive mechanisms without data on global diversity are unwarranted (Nielsen, Haun, Kaertner, & Legare, 2017). Prioritizing studying cultural diversity in programs of research would also encourage researchers to utilize cutting-edge and state-of-the-art methodologies and tools, elevating evolutionary developmental science programs. Below we describe an example of a comparative, cross-cultural, and developmental program of research on cultural learning and social group cognition and behavior, all based on evolutionary theory.

### Comparative Perspectives on Cultural Learning

Cultural variation in humans is unique among animals and differs dramatically even from our closest primate relatives (Boyette & Hewlett, 2017; Henrich, 2015b; Lew-Levy, Reckin, Lavi, Cristóbal-Azkarate, & Ellis-Davies, 2017; Mesoudi, Chang, Murray, & Lu, 2015; Terashima & Hewlett, 2016). Here culture is defined as "group-typical behaviors shared by members of a community that rely on socially learned and transmitted information" (Laland & Hoppitt, 2003). Although nonhuman animals may have the ability to learn social information (Aplin, 2015; Leadbeater, 2015; Perry et al., 2003; Plotnik, Lair, Suphachoksahakun, & de Waal, 2011; Whitehead & Rendell, 2015) and to transmit group-specific behavior (Cantor et al., 2015; Garland et al., 2013; Laland & Galef, 2009), humans display a much wider repertoire of socially acquired and transmitted behaviors that vary more across groups

than nonhuman animals (Dean, Vale, Laland, Flynn, & Kendal, 2014; Johnson-Pynn, Frigaszy, & Cummins-Sebree, 2003).

How does human cognition differ from nonhuman primate cognition? One potential candidate is cross-species variation in social cognition (van Schaik & Burkart, 2011). Our prolonged early development also sets humans aside from other primates. As Bjorklund and others suggest, natural selection favored an extended childhood to allow for increased flexibility in cognitive development (Bjorklund, 2018; Bjorklund & Ellis, 2014). During this extended juvenile period, our offspring are dependent on adults for survival, and in turn, this dependency increases opportunities for interaction with caregivers and enables social learning (Hublin, 2005).

The technological and social complexity of human populations is due to our ability for cumulative cultural transmission, a process by which the discoveries and inventions of others are built upon to create increasingly complex reserves of socially heritable knowledge (Henrich, 2015b). Human psychological flexibility allows us to build upon established behaviors by relinquishing old solutions and flexibly switching to more productive or efficient ones (Davis, Vale, Schapiro, Lambeth, & Whiten, 2016). Evidence for culture in nonhuman species continues to grow, but there is little evidence for the accumulation of cultural innovation in nonhuman animals. Recent comparative research has examined the development of social learning and imitative flexibility across hominin evolutionary history (Whiten, 2017). Comparative research on this topic will increase our knowledge of how cognitive capacity may constrain young children's and chimpanzees' learning potential and technological skill, as well as elucidating the diverse learning heuristics that children and chimpanzees employ. Although largely absent from Bjorklund's commentary, research contrasting children's and other primates' social cognition adds to our understanding of the origins of cumulative culture in humans and evolutionary theory more broadly.

### Development and Diversity of Cultural Learning

Young children are adept at acquiring the beliefs and practices of whatever group they are born into, a cognitive capacity that requires substantial flexibility. We agree with Bjorklund that the sociocognitive mechanisms that children display are not the "derivatives of 'hard' cognition" but a set of critical psychological adaptations in their own right

(Bjorklund, 2018, p. 15). For example, children have a number of cognitive biases that aid in the acquisition of their specific cultural practices. These biases include preferences for learning from those who are from similar social groups (Kinzler, Dupoux, & Spelke, 2007), those who conform (Haun & Over, 2014) and display behavioral or cognitive consensus with others (Claidière & Whiten, 2012; Corriveau, Fusaro, & Harris, 2009; Herrmann, Legare, Harris, & Whitehouse, 2013), and those who display prestige (Chudek, Heller, Birch, & Henrich, 2012; Henrich, 2009).

Missing from Bjorklund's commentary on the development of the sociocognitive brain and the social brain hypothesis (Bjorklund, 2018, p. 15) is a discussion of the flexibility and diversity of children's social learning. We argue that studying the flexibility and diversity of children's sociocognitive development provides insight into the evolution and ontogeny of human culture. This same flexibility and diversity provides an interesting evolutionary problem—if children's capacity for social learning explains cultural transmission, the psychological mechanisms should be universal, but these psychological mechanisms must also be responsive to diverse ontogenetic contexts and cultural ecologies (Apicella & Barrett, 2016; Hrdy, 2009; Legare & Harris, 2016; Nielsen et al., 2017). To address this problem, we must first ask: How is culture acquired?

Children possess cognitive and communication systems that evolved to acquire the complicated technical and social skills characteristic of human cultures. They are attentive to social input and learn important skills and information through observation. Another way that children acquire cultural knowledge and practices is through imitation. As Bjorklund mentions, we know that children are also precocious imitators and "overimitation" may be an adaptive learning strategy to promote the high-fidelity acquisition and transmission of behavior. Is high fidelity copying an adaptation that provides the psychological foundation of human cultural transmission? What is the function of imitation? We have developed an integrated cognitive psychological and ontogenetic account of how imitation and innovation work in tandem to drive cultural learning and facilitate our capacity for cumulative culture. We propose that the unique demands of acquiring instrumental skills (based on physical causation) and rituals (based on social convention) provide insight into when children imitate, when they innovate, and to what degree. For instrumental learning, with an increase in experience, high-fidelity

imitation decreases and innovation increases. In contrast, for conventional learning, imitative fidelity stays high, regardless of experience, and innovation stays low (Legare & Nielsen, 2015).

What distinguishes instrumental from ritual practices is a matter of interpretation based on contextual information and social cues. We have used both quantitative and qualitative methodologies to examine the kind of information children use to determine when an event provides an opportunity for learning instrumental skills versus learning cultural conventions (Clegg & Legare, 2016b; Legare, Wen, Herrmann, & Whitehouse, 2015), the implications of learning instrumental skills versus learning cultural conventions for social group behavior (Watson-Jones & Legare, 2016; Watson-Jones, Legare, Whitehouse, & Clegg, 2014; Wen, Herrmann, & Legare, 2016), and socialization of instrumental skills versus cultural conventions in early childrearing environments (Clegg & Legare, 2017; Clegg, Wen, & Legare, 2017). Data from cross-cultural research have demonstrated that children use imitation flexibly to acquire the specific practices, beliefs, and values of their groups (Clegg & Legare, 2016a).

To understand the ontogeny of human social learning, we must examine how it changes over the life span and how it varies in a strategically selected set of cultural contexts that differ along theoretically relevant variables. How do caregiver socialization practices and the development of social learning capacities enable and structure cumulative cultural transmission? We are addressing the question by studying the impact of diverse childrearing environments, practices, and social dynamics on the development of cultural learning. For example, we conduct research in educational settings and home environments in both the United States (Austin, Texas) and Vanuatu (Tanna; Clegg & Legare, 2016a). Vanuatu, a Melanesian island nation in the South Pacific, is one of the most remote, culturally and linguistically diverse, and understudied countries in the world. Vanuatu provides a unique opportunity to explore the development of cultural learning in populations that vary in extent of Western influence. Conducting this research cross-culturally in Vanuatu and the United States allows us to examine the imitative foundations of cultural learning in contexts that represent key aspects of the diversity of human childrearing practices.

Humans are uniquely able to accumulate and build upon the cultural innovations of previous generations (Kurzban & Barrett, 2012; Pagel, 2012; Pradhan, Tennie, & van Schaik, 2012; Whiten & Erdal, 2012). Teaching and imitation work in tandem

to conserve and transmit group-specific cultural knowledge, increasing the likelihood for modifications and innovations, thus enhancing cultural complexity (Enquist, Strimling, Eriksson, Laland, & Sjostrand, 2010). Developing a comprehensive understanding of teaching and imitation requires the systematic study of cultural variation in childrearing practices (Nielsen et al., 2017). We can enrich our understanding of the developmental origins of cumulative cultural transmission by conducting cross-cultural research on cognitive and social development (Legare & Harris, 2016).

In sum, comparative, developmental, and cross-cultural research guided by evolutionary theory provides insight into the evolution and ontogeny of human cognition and behavior. Evolutionary theory has made a profound and permanent impact on the field of developmental psychology, shaping our own research programs, as well as those of many others. Bjorklund deserves substantial credit for this striking scientific success story and should be feeling very well indeed.

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