

Original Article

An Introduction to Evolutionary Developmental Psychology

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Abstract: Evolutionary developmental psychology represents a synthesis of modern evolutionary theory and developmental psychology. Here we introduce the special issue on evolutionary developmental psychology by briefly discussing the history of this field and then summarizing the variety of topics that are covered. In this special issue, leading researchers provide a collection of theoretical and empirical articles that highlight recent findings and propose promising areas for future research.

Keywords: evolution, development, evolutionary psychology, developmental psychology, evolutionary developmental psychology

Introduction

Evolutionary and developmental theory have had a tumultuous history, occasionally being viewed as detached, incompatible fields of study. However, this was not the case when the theory of evolution by natural selection was originally proposed by Darwin (1859), who acknowledged in *The Origin of Species* the relationship between development and his theory, painstakingly describing the process of embryology and using it as part of his indisputable evidence for evolution. Emphasizing the importance of development, Darwin (1860) once wrote, “Embryology is to me by far the strongest single class of facts in favor of change of forms, and not one, I think, of my reviewers has alluded to this.”

The separation of the two fields was, arguably, due primarily to the discovery of genetics and the Modern Synthesis (Huxley, 1942) and the perceived implications of this revised version of evolutionary theory. The field became strictly “gene-centric,” incorporating Mendelian genetics into the theory of natural selection. Although this resulted in the general dismissal of development, it was a massive advancement for the theory of evolution. The Modern Synthesis reflected the official acceptance of evolution by

natural selection by the scientific community. Unfortunately, development became an afterthought, perfectly highlighted by Richard Dawkins' (2006/1976) assumption that "The details of embryological developmental processes, interesting as they may be, are irrelevant to evolutionary considerations" (p. 62).

The field of evolutionary psychology was born when pioneering psychologists realized that modern evolutionary theory could be applied to cognitive processes, and thus could potentially explain and predict many aspects of human behavior (see Buss, 1995; Daly and Wilson, 1988; Tooby and Cosmides, 1992). Understandably, the primary focus of mainstream evolutionary psychology was on adult behavior initially. After all, adults do the "stuff" of mating, arguably the critical measure of evolutionary success.

This focus on adult behavior and cognition served the field well. It allowed a deeper insight into the question of *why* humans behave the way they do, rather than just answering *how* do humans behave. Development, although interesting and necessary for reaching the crucial adult period, was seen as incidental as it did not seem to aid in answering these important "why" questions.

The survival of infancy and childhood is no easy feat, though; surviving in childhood is just as risky, if not more so, than surviving in adulthood. In fact, the likelihood of a newborn dying before reaching adolescence has historically been approximately 50% in traditional societies (Volk and Atkinson, 2008), and was likely higher for our ancestors. This makes childhood the "crucible" of evolution (Volk and Atkinson, 2008), such that any cognitive or behavioral adaptations that increase the chance of surviving from childhood to adulthood should be favored by natural selection. The realization that natural selection operates at all stages of the lifespan, and possibly operates more strongly at some stages, especially early in development, led to the formation of *evolutionary developmental psychology* (see Bjorklund, Ellis, and Rosenberg, 2007; Bjorklund and Pellegrini, 2000, 2002; Burgess and MacDonald, 2005; Ellis and Bjorklund, 2005; Geary and Bjorklund, 2000).

Evolutionary developmental psychology was defined by Bjorklund and Pellegrini (2002) as:

... the study of the genetic and environmental mechanisms that underlie the universal development of social and cognitive competencies and the evolved epigenetic (gene-environment interactions) processes that adapt these competencies to local conditions; it assumes that not only are behaviors and cognitions that characterize adults the product of selection pressures operating over the course of evolution, but so also are characteristics of children's behaviors and minds. (p. 4)

In other words, this field represents the application of the basic principles of evolution to contemporary human development, postulating that natural selection operates throughout ontogeny. It seeks to answer the question of how inherited behaviors and cognitions get expressed in the phenotypes of individuals across the lifespan.

Integrating evolutionary and developmental theory

A strict evolutionary approach usually encounters the problem of *genetic determinism*, the idea that genes directly cause, or determine, behavior (e.g., Lickliter and Honeycutt, 2003; Spencer et al., 2009) in that genes (perhaps, the basic units of inheritance)

influence evolved behavior and cognitions, suggesting that there is little one can do to change “human nature.” Although evolutionary psychologists explicitly reject this view and acknowledge the interaction between genes and the environment, evolutionary developmental psychology specifies this relationship in more detail by adopting a *developmental systems approach* (Gottlieb, 2002, 2007), which states that genes and the environment interact at all levels of organization, from one’s genes through society. Central to the developmental systems approach is the concept of *epigenesis*, which Gilbert Gottlieb (1991) defined as “the emergence of new structures and functions during the course of development” (p. 7). New structures or behaviors are the result of the bidirectional relationship between all levels of biological and experiential factors, with function at one level influencing function at adjoining levels and constant feedback in between. Because the experiences of every individual are unique, there should be substantial plasticity (i.e., individual differences) in development. Most individuals, however, share many features. Evolutionary developmental psychology posits that this is because individuals inherit a species-typical environment, as well as a species-typical genome. Development follows a species-typical pattern given that individuals within the species grow up in environments that are similar to those of their ancestors.

An evolutionary developmental perspective posits that an extended childhood is necessary to acquire the skills needed for the complexities of the human social world. Human children have a longer juvenile period than any other mammal, suggesting that there is a substantial benefit associated with this costly trait, such as allowing for the development of a large brain capable of acquiring the skills necessary to navigate the social world (Bjorklund, Cormier, and Rosenberg, 2005; Dunbar, 1995, 2010). The intricacies of the social world are highly varied, and acquiring the ability to compete and cooperate with other complex humans takes time.

Additionally, since natural selection operates throughout ontogeny, and not just when individuals are reproductively viable, evolutionary developmental psychology posits the existence of adaptations specifically associated with infancy and childhood. Rather than simply serving as preparation for adulthood, or representing incomplete versions of adult characteristics, some traits were selected for because they serve an adaptive function at a specific time in development. These are known as *ontogenetic adaptations* (Bjorklund, 1997). Ontogenetic adaptations emerge at different times in development and adapt the child for challenges specific to that time. These adaptations may then disappear when they are no longer functional. *Deferred adaptations*, on the other hand, are those properties of infancy and childhood that were selected for their function in preparing children for adulthood (Hernández Blasi and Bjorklund, 2003). These adaptation can be seen as “adult training,” and help children explicitly learn the skills necessary for adulthood.

Lastly, given the uncertainty of survival through childhood and the varying conditions throughout development over evolutionary history, evolutionary developmental psychologists argue that children have evolved behavioral and cognitive flexibility in order to direct their development in anticipation of adult environments. These take the form of what is termed *conditional adaptations*; that is, adaptations that are dependent on conditions of the immediate environment and serve to direct children’s subsequent development (Boyce and Ellis, 2005).

Although evolutionary psychologists were initially reluctant to incorporate developmental ideas into their theories and research (and vice versa), the role of developmental thinking in explaining important aspects of human evolution has increased over the past decade. A recent special issue in *Developmental Psychology* (Ellis and Bjorklund, 2012, Vol. 48) examining development under risky and supportive environmental conditions provided a host of new and informative findings from an evolutionary perspective to a developmental audience. In a similar vein, this special issue serves to highlight the recent literature that integrates evolutionary and developmental perspectives, and present it to an evolutionary audience.

Overarching Topics of the Special Issue

Childhood context: Early family

This special issue begins by highlighting the classical findings that catalyzed the field of evolutionary developmental psychology. Webster, Graber, Gesselman, Crosier, and Schember (this issue) present a meta-analysis examining the age of menarche in girls from father-absent homes. Menarche is used as a clear indicator of the initial pubertal process in girls, approaching the benchmark of reproductive age. The timing of girls' (and all organisms') reproductive viability is, according to life history theory, an important milestone. In line with an evolutionary developmental perspective, life history theory states that a tradeoff between resources on somatic (physical) development versus reproductive efforts exists because a person cannot concurrently maximize all features of evolutionary fitness. Somatic development factors include physical growth, brain maturation, and social learning. Reproductive factors include sexual development, mating behaviors, gestation, and parenting. Choices along this somatic-reproductive continuum are made across a given lifespan, and these choices make up an organism's life-history strategy.

Early menarche suggests a different life-history strategy for girls than later menarche. Belsky, Steinberg, and Draper (1991) found that early environments can regulate and predict later reproductive strategies, at least in females. Their theory, termed *psychosocial acceleration theory*, later the basis for *differential susceptibility*, proposed that experiences in early childhood influence children's somatic and behavioral development, which subsequently affect pubertal timing and reproductive strategies that serve to match an adaptive life history strategy to the local environment.

From this framework, the early emergence of reproductive ability suggests that the early environment is substantially different (e.g., more stressful, less predictable; Ellis et al., 2012) than the environments experienced by girls with a later emergence of menarche. One measure of stress in early environment that is found to be of particular importance is father absence. The meta-analysis reported by Webster et al. (this issue) examines the variation in age of menarche as a function of father absence, providing further support for these principal findings, while underlining some new directions of inquiry that can further elucidate these effects.

Chasiotis, Bender, and Hofer (this issue) extend the findings that early environmental factors can serve to alter the context of childhood by examining both parental socioeconomic status (SES) and number of siblings as indicators of early

environmental stress. Their primary measure is differences in implicit parenting motivation, a preverbal and, therefore, possibly evolutionarily relevant motivation for parenting behaviors. One of the most important trade-offs involves investment in one's offspring, suggesting that parental motivations, specifically implicit ones, may add to our understanding of the evolutionary importance of early childhood experiences. Furthermore, in order to steer away from simply examining W.E.I.R.D. populations (Henrich, Heine, and Norenzayan, 2010), Chasiotis and his colleagues collected data from Chinese, Cameroonian, Costa Rican, and German populations. The findings of this paper suggest that other factors contributing to early environments should be examined in order to get a fuller picture of the factors influencing children's life history strategies.

Navigating the social world

Although parental influences are highly important, they only serve as one part of a bigger picture in understanding the evolution of childhood. Humans evolved an extended childhood partially to allow for the child to be able to navigate through the complexities of the human social realm. Navigating the peer group represents a significant adaptive problem, and balancing and coping with conflict, competition, and cooperation are hypothesized to be focal developmental achievements of childhood.

Hawley (this issue) uses a life-history framework to present a theoretical model of competitive behaviors in the peer group (in childhood and adulthood), resource control theory, which posits that both aggressive (i.e., coercive) and prosocial (i.e., cooperative) behaviors serve adaptive functions when strategically implemented in the appropriate contexts. Her reformulation highlights the misconceptions of prosocial behaviors (its confusion with altruism or altruistic motivations) and aggressive behaviors (its confusion with negative, maladaptive outcomes that should always be eliminated). Similarly, Ingram (this issue) examines the function and development of indirect and direct aggression and how the expressions of aggression shift across development. Martin, Davies, and MacNeill (this issue) further the discussion of children coping with challenges and conflicts in the peer group by examining how children deal with hostile peer relationships and guard themselves from interpersonal threat. Conversely, O'Brien (this issue) examines an evolutionary model for the development of prosociality. He proposes a model consisting of two psychological mechanisms, one domain specific and the other domain general, that underlie the evolution of prosociality.

Toward consilience

The field of evolutionary psychology in general represents an important step toward consilience, or the unification of different branches of knowledge (Wilson, 1999). In addition to connecting the study of human behavior to evolutionary theory, it also has the potential to serve as a unifying framework across the currently disparate subfields of psychology (Shackelford and Liddle, 2014). Evolutionary developmental psychology furthers this endeavor, both by unifying evolutionary and developmental theory and by providing a more nuanced framework for unifying the psychological sciences.

Although this special issue as a whole serves as an illustration of progress toward

consilience, the last several articles emphasize this goal in unique ways. Pandeirada, Pires, and Soares (this issue) present empirical work intersecting the fields of evolutionary, developmental, and cognitive psychology by investigating memory functioning in children. More specifically, they test the “survival processing” function of memory, in which memory performance is enhanced by encoding information with respect to its relevance in an imagined survival scenario (Nairne, Thompson, and Pandeirada, 2007). This article represents an important addition to the survival-processing effect literature not only by testing children, which has been done rarely up to this point, but also by testing a new cultural group, thereby expanding the generalizability of the results.

Rottman (this issue) propels consilience in a different way, by further integrating evolutionary and developmental approaches to human behavior and illustrating how each approach can inform the other. Whereas evolutionary developmental psychology often consists of applying an evolutionary perspective to better understand developmental phenomena, Rottman emphasizes the utility of the less common, converse approach: applying developmental evidence to inform and evaluate claims about evolved function. This approach is illustrated in this article by focusing on evaluating claims about the evolved function of disgust. By analyzing disgust in terms of its developmental trajectory and the flexibility of the inputs that elicit disgust, Rottman re-evaluates the functional hypothesis that disgust evolved to allow humans to avoid ingesting pathogens, and in doing so illustrates how this approach can be applied to arguably any topic within evolutionary developmental psychology.

Greve, Thomsen, and Dehio (this issue) discuss how play, which they argue to be a crucial deferred adaptation, might improve individuals’ reproductive success. They argue that play provides children with the opportunity to be socially successful, which in turn is predictive of being reproductively successful. Using a cross-sectional questionnaire study, they are able to conclude that free play in childhood is a predictor of later social success, which they term “the Fitness-Effect.”

Finally, Rosati, Wobber, Hughes, and Santon (this issue) further emphasize the goal of consilience by applying a comparative developmental approach to human cognition. This approach has the potential to advance our understanding of human cognition by investigating differences in the *pace* and *pattern* of cognitive development across species. Rosati et al. focus their analysis on object reasoning, foraging skills, and social cognition, but they also discuss how a comparative developmental approach can aid in tackling currently unsolved questions regarding human cognition, such as the development of theory of mind.

Conclusion

Evolutionary and developmental theory have not always been on the same page, but now more than ever researchers are acknowledging the importance of both ontogeny and phylogeny and working to understand the complex ways in which they interact to influence behavior across the lifespan. Both evolutionary psychologists and developmental psychologists can benefit from considering the ideas put forth by the unified field of evolutionary developmental psychology, and we hope that this special issue serves as a

helpful collection of these ideas and their application across a variety of topics of interest to both camps.

References

- Belsky, J., Steinberg, L., and Draper, P. (1991). Childhood experience, interpersonal development, and reproductive strategy: An evolutionary theory of socialization. *Child Development, 62*, 647-670.
- Bjorklund, D. F. (1997). The role of immaturity in human development. *Psychological Bulletin, 122*, 153-169.
- Bjorklund, D. F., Cormier, C., and Rosenberg, J. S. (2005). The evolution of theory of mind: Big brains, social complexity, and inhibition. In W. Schneider, R. Schumann-Hengsteler, and B. Sodian (Eds.), *Young children's cognitive development: Interrelationships among executive functioning, working memory, verbal ability and theory of mind* (pp. 147-174). Mahwah, NJ: Erlbaum.
- Bjorklund, D. F., Ellis, B. J., and Rosenberg, J. S. (2007). Evolved probabilistic cognitive mechanisms: An evolutionary approach to gene-environment-development. In R. V. Kail (Ed.), *Advances in child development and behavior*, Vol. 35 (pp. 1-39). Oxford: Elsevier.
- Bjorklund, D. F., and Pellegrini, A. D. (2000). Child development and evolutionary psychology. *Child Development, 71*, 1687-1708.
- Bjorklund, D. F., and Pellegrini, A. D. (2002). *The origins of human nature: Evolutionary developmental psychology*. Washington, DC: American Psychological Association.
- Boyce, W. T., and Ellis, B. J. (2005). Biological sensitivity to context: I. An evolutionary-developmental theory of the origins and functions of stress reactivity. *Development and Psychopathology, 17*, 271-301.
- Burgess, R., and MacDonald, K. (Eds.) (2005). *Evolutionary perspectives on human development*. CA: Sage Publications.
- Buss, D. M. (1995). Psychological sex differences: Origins through sexual selection. *American Psychologist, 50*, 164-168.
- Chasiotis, A., Bender, M., and Hofer, J. (2014). Childhood context explains cultural variance in implicit parenting motivation: Results from two studies with six samples from Cameroon, Costa Rica, Germany, and PR China. *Evolutionary Psychology, 12*, 295-317.
- Daly, M., and Wilson, M. (1988). *Homicide*. New York: Aldine.
- Darwin, C. (1859). *On the origin of species*. London: J. Murray.
- Dawkins, R. (2006). *The selfish gene*. Oxford: Oxford University Press [originally printed 1976].
- Dunbar, R. I. M. (1995). Social networks, support cliques, and kinship. *Human Nature, 6*, 273-290.
- Dunbar, R. I. M. (2010). Brain and behaviour in primate evolution. In P. M. Kappeler and J. B. Silk (Eds.), *Mind the gap: Tracing the origins of human universals* (pp. 315-330). New York: Springer.
- Ellis, B. J., and Bjorklund, D. F. (Eds.) (2005). *Origins of the social mind: Evolutionary*

- psychology and child development*. New York: Guilford.
- Ellis, B. J., and Bjorklund, D. F. (Eds.) (2012). Beyond mental health: An evolutionary analysis of development under risky and supportive environmental conditions: Introduction to Special Section. *Developmental Psychology*, 48, 591-597.
- Geary, D. C., and Bjorklund, D. F. (2000). Evolutionary developmental psychology. *Child Development*, 71, 57-65.
- Gottlieb, G. (1991). Experiential canalization of behavioral development: Theory. *Developmental Psychology*, 27, 4.
- Gottlieb, G. (2002). Developmental-behavioral initiation of evolutionary change. *Psychological Review*, 109, 211-218.
- Gottlieb, G. (2007). Probabilistic epigenesis. *Developmental Science*, 10, 1-11.
- Greve, W., Thomsen, T., and Dehio, C. (2014). Does playing pay? The fitness-effect of free play during childhood. *Evolutionary Psychology*, 12, 434-447.
- Hawley, P. H. (2014). Ontogeny and social dominance: A developmental view of human power patterns. *Evolutionary Psychology*, 12, 318-342.
- Henrich, J., Heine, S. J., and Norenzayan, A. (2010). The weirdest people in the world. *Behavioral and Brain Sciences*, 33, 61-135.
- Hernández Blasi, C., and Bjorklund, D. F. (2003). Evolutionary developmental psychology: A new tool for better understanding human ontogeny. *Human Development*, 46, 259-281.
- Huxley, J. (1942). *Evolution, the modern synthesis*. New York: Harper Brothers.
- Ingram, G. P. D. (2014). From hitting to tattling to gossip: An evolutionary rationale for the development of indirect aggression. *Evolutionary Psychology*, 12, 343-363.
- Lickliter, R., and Honeycutt, H. (2003) Developmental dynamics: Toward a biologically plausible evolutionary psychology. *Psychological Bulletin*, 129, 819-835.
- Martin, M. J., Davies, P. T., and MacNeill, L. A. (2014). Social defense: An evolutionary-developmental model of children's strategies for coping with threat in the peer group. *Evolutionary Psychology*, 12, 364-385.
- Nairne, J. S., Thompson, S. R., and Pandeirada, J. N. S. (2007). Adaptive memory: Survival processing enhances retention. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33, 263-273.
- O'Brien, D. T. (2014). An evolutionary model of the environmental conditions that shape the development of prosociality. *Evolutionary Psychology*, 12, 386-402.
- Pandeirada, J. N. S., Pires, L., and Soares, S. C. (2014). Revisiting the survival mnemonic effect in children. *Evolutionary Psychology*, 12, 403-416.
- Rosati, A. G., Wobber, V., Hughes, K., and Santos, L. R. (2014). Comparative developmental psychology: How is human cognitive development unique? *Evolutionary Psychology*, 12, 448-473.
- Rottman, J. (2014). Evolution, development, and the emergence of disgust. *Evolutionary Psychology*, 12, 417-433.
- Shackelford, T. K., and Liddle, J. R. (2014). Understanding the mind from an evolutionary perspective: An overview of evolutionary psychology. *WIREs Cognitive Science*, 5, 247-260.
- Spencer, J. P., Blumberg, M. S., McMurray, B., Robinson, S. R., Samuelson, L. K., and

- Tomblin, J. B. (2009). Short arms and talking eggs: Why we should no longer abide the nativist–empiricist debate. *Child Development Perspectives*, 3, 79-87.
- Tooby, J., and Cosmides, L. (1992). The psychological foundations of culture. In J. H. Barkow, L. Cosmides, and J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 19-139). New York: Oxford University Press.
- Volk, T., and Atkinson, J. (2008). Is child death the crucible of human evolution? *Journal of Social, Evolutionary and Cultural Psychology*, 2, 247-260.
- Webster, G. D., Graber, J. A., Gesselman, A. N., Crosier, B. S., and Schember, T. O. (2014). A life history theory of father absence and menarche: A meta-analysis. *Evolutionary Psychology*, 12, 273-294.
- Wilson, E. O. (1999). *Consilience: The unity of knowledge* (reprint). New York: Vintage Books.