European Journal of Developmental Psychology

ISSN: 1740-5629 (Print) 1740-5610 (Online) Journal homepage: http://www.tandfonline.com/loi/pedp20

James Mark Baldwin and contemporary theories of culture and evolution

Thomas J.H. Morgan & Paul L. Harris

To cite this article: Thomas J.H. Morgan & Paul L. Harris (2015): James Mark Baldwin and contemporary theories of culture and evolution, European Journal of Developmental Psychology, DOI: 10.1080/17405629.2015.1074068

To link to this article: http://dx.doi.org/10.1080/17405629.2015.1074068

EUROPEAN JOURNAL OF DEVELOPMENTAL PSYCHOLOGY, 2015
http://dx.doi.org/10.1080/17405629.2015.1074068

James Mark Baldwin and contemporary theories of culture and evolution

Thomas J.H. Morgan[1], and Paul L. Harris[2]

[1]UC Berkeley, Berkeley, USA
[2]Harvard University, Cambridge, USA

At the end of the nineteenth century, James Mark Baldwin was amongst America's foremost psychologists and his ideas concerning the interactions between development and evolution were widely discussed. Richards' [Richards (1987). *Darwin and the emergence of evolutionary theories of mind and behavior*. Chicago, IL: The University of Chicago Press] eloquent and sympathetic account of Baldwin's career devotes little space to the final period of Baldwin's life—from 1909 until his death in 1934—when professional scandal forced his relocation to Paris. Although Baldwin conducted no further empirical research in this period and his theories began to be displaced by the rediscovery of Mendelian inheritance, he continued to discuss the links between ontogenesis and phylogenesis with notable thinkers in the French-speaking world, including Pierre Janet. Piaget, who attended Janet's lectures during his two-year stay in Paris immediately after World War I, was also exposed to Baldwin's ideas. Looking back many years later, Piaget denied that Baldwin's theorizing had a deep influence on his own thinking. Nonetheless, Piaget's emphasis on ever more elaborate stages of cognitive development echoes important themes in Baldwin's work. Despite this, Piaget certainly did not assimilate Baldwin's important ideas about the transmission of culture—what Baldwin called "Social Heredity". Piaget's neglect of this strand in Baldwin's conception of development has had major consequences for the study of cognition. Here we discuss the contemporary re-awakening of interest in Baldwin's ideas among biologists and suggest that it is time for developmental psychology to reconsider the centrality of cultural learning in early cognitive development.

Keywords: Baldwin; Piaget; Evolution; Culture.

BALDWIN, ORGANIC SELECTION AND SOCIAL HEREDITY

Baldwin's early research interests chiefly concerned the reconciliation of science with philosophy to produce a novel approach for the study of mind. Whilst a keen

Correspondence should be addressed to Thomas J. H. Morgan, UC Berkeley, Berkeley, USA. E-mail: thomas.morgan@berkeley.edu
No potential conflict of interest was reported by the authors.

Darwinist and a monist, his spiritual convictions lead him to conclude that the mind was not the product of a complex material organism, but rather that mental complexity preceded and was reflected in organismal complexity; a "monism of mind" (Baldwin, 1890). In 1895—well before his fall from grace—Baldwin published *Mental Development in the Child and the Race* (Baldwin, 1895), his first book to venture into developmental psychology. Baldwin had already acknowledged the importance of developmental and evolutionary studies to a full understanding of the mind in his earlier *Handbook of Psychology: Sense and Intellect* (1889, p. 14). Nonetheless, two different influences were likely to have played a more immediate role in this new research orientation. The first was the publication of an English translation of Wilhelm Preyer's book *The Mind of the Child* in 1888. As explained by Koops (this volume), Preyer taught alongside Ernst Haeckel at the University of Jena and, like Haeckel, was interested in the relationship between ontogenesis and phylogenesis. This would have fed into Baldwin's own thinking who, in *Mental Development*, suggested that mental growth and evolution followed similar principles. In the preface to the English edition of his book, Preyer writes:

> The mind of the new-born child, then, does not resemble a tabula rasa, upon which the senses first write their impressions, so that out of these the sum-total of our mental life arises, through manifold reciprocal action, but the tablet is already written upon before birth, with many illegible, nay, unrecognizable and invisible, marks, the traces of the imprint of countless sensuous impressions of long-gone generations.

The question of what these marks were and how they came to be would be a key consideration for the remainder of Baldwin's career.

The second influence on Baldwin was more personal; the birth of his two daughters in 1889 and 1891. An unusually hands-on father for the time, the initial immaturity and subsequent development of his children's mental abilities would have been clear to Baldwin. Wozniak (1982) has argued that it was these observations that caused Baldwin to move away from the "intuitive realism" of his mentor James McCosh, which held that intuition was an innate and reliable guide to reality. Richards (1987), however, takes a somewhat different view, suggesting that Baldwin only ever partially endorsed McCosh and that the birth of his daughters simply afforded Baldwin an excellent opportunity to study the ontogeny of mind. Regardless, in the run-up to *Mental Development*, published in 1895, Baldwin published a number of papers documenting the development of his children's behaviour, which—in accordance with his beliefs concerning the relationship between mind and body—he believed documented the development of their minds also.

The next year, still more than a decade before his migration to Paris, Baldwin wrote a paper for the *American Naturalist*, "*A New Factor in Evolution*", in which he meditated on the same theme as Preyer: How might past experience, accumulated or at least repeated over many generations, come to shape the mind

of the child? Baldwin billed his paper as a synthesis and clarification of several papers he had published in a variety of journals over the preceding several years. However, it may also have been an attempt to claim priority on ideas circulating in the academic community at that time, some of which were only tenuously present in his previous work. The paper in the *American Naturalist* is divided into two parts. The first part focuses on (and to a certain extent, redefines) what Baldwin called "Organic Selection" and the second on "Social Heredity". To a modern ear, Baldwin's terminology and the implied themes sound somewhat alien but they deserve explanation and exegesis.

In setting out his concept of Organic Selection, Baldwin speculated that an animal (including *Homo sapiens*) might—in response to some environmental challenge—produce an adaptive behaviour that would stave off extinction. Combining this with Darwinian evolution, he further supposed that natural selection, by extinguishing individuals incapable of making the relevant environmental accommodation, would favour whatever congenital variations among individuals facilitated, or simply accompanied, that adaptive behaviour. Hence, over successive generations, if the challenge persisted, a congenital capacity for the adaptation would come to be entrenched via heredity—it would become more than a temporary behaviour acquired in the course of a lifetime and indeed even more than a strategy or habit re-learned by each successive generation. As such, Baldwin proposed that a learned trait could effectively become inherited, or at least highly "prepared" i.e., rapidly and easily acquired.

Baldwin was effectively offering a Darwinian alternative to the Lamarckian inheritance of acquired characteristics. Baldwin's speculation was not actually Lamarckian because he was proposing that natural selection was at work—favouring those with the capacity for the ontogenetic adaptation in question. Nevertheless, in keeping with Baldwin's view of the mind as a driving force in biology, it echoed the Lamarckian idea that acquired or learned tendencies could influence the direction of evolution, or at least the conditions under which natural selection might operate. This type of selection in which an adaptive ontogenetic change is subjected to natural selection has come to be known as the "Baldwin effect" (Simpson, 1953).

Similar ideas were published at approximately the same time by contemporary biologists, notably Osborne (1896) and Morgan (1896) and subsequent historical analysis has suggested that there was a certain amount of jockeying for intellectual priority (Richards, 1987). In any case, in a subsequent book, *Development and Evolution* published in 1902, Baldwin revisited and extended the ideas that he had proposed earlier in the *American Naturalist*. As explained in the preface to the book, he took the somewhat unusual step of republishing the relevant papers by Osborn and Morgan in an Appendix as well as including these colleagues in the dedication. It is reasonable to conclude that the statement set out in *Development and Evolution* was the product of relatively intense debate and discussion; it can be regarded as Baldwin's most considered statement.

Organic selection was not without its conceptual difficulties. For example, as noted by West-Eberhard (2003), Baldwin conceived of it as a mechanism that could, in principle, lead to the reduction of plasticity as the trait in question comes under increasingly powerful genetic influence. Yet this stands at odds with the remarkable flexibility exhibited by observed organisms. Baldwin's response was to argue that organic selection could, in fact, drive greater plasticity. For example, he writes:

> [organic selection] opens a great sphere for the application of the principle of natural selection among organisms, *i.e. selection on the basis of what they do rather than what they are*; of the new use they make of their functions rather than of the mere possession of certain congenital characteristics. A premium is set on plasticity and adaptability of function rather than on congenital fixity of structure; and this adaptability reaches its highest levels in the intelligence. (Baldwin, 1902, p. 117)

Baldwin evidently viewed organic selection as fully consistent with natural selection but also as pushing it in new directions, especially in the cognitive sphere.

This sentiment is reflected in contemporary discussion of the Baldwin Effect by Dennett (2003), who argues that natural selection acting on plastic organisms could foster the evolution of intelligence. The logic of this argument is as follows: consider a population of organisms who, faced with some challenge, rely on their plasticity to improve their chances of survival and reproduction. Further imagine that there are several possible successful behaviours the organisms could perform, but that the most effective behaviours are beyond the cognitive capacities of the organisms. Dennett argues that Baldwin's ideas offer a route by which the population can reach the dizzying heights of the most complex behaviours. At first, selection favours the most intelligent organisms because they are more adept at acquiring the simple behaviours. However, as the relevant cognitive abilities spread and intelligence increases, some individuals will discover the next behaviour. Now selection will redouble, favouring even more complex intelligence to support these new discoveries. This process will ratchet the population towards the most complex behaviour and its corresponding cognitive abilities. Recent theoretical work has shown this process to work provided that the intelligence favoured in order to sustain each behaviour has a non-zero probability of discovering the next behaviour (Morgan, in press).

The second part of Baldwin's *New Factor* paper recapitulates his ideas about Social Heredity. These were already discussed at length in *Mental Development*, where Baldwin advocated an explicitly social take on the developing mind of children with virtually all beliefs coming from exposure to social models as opposed to the child's own considerations. They would also be revisited in his next book—*Social and Ethical Interpretations in Mental Development*—where he offers the following vivid description of Social Heredity: "the mass of organized tradition, custom, usage, social habit, etc., which is already embodied

in the institutions and ways of acting, thinking, etc., of a given group, considered as the normal heritage of the individual child" (Baldwin, 1897, p. 301).

Baldwin's account of Social Heredity was sufficiently similar to that of Tarde, who had developed a theory of social imitation that it led to more assertions of priority from Baldwin. However, unlike Tarde, Baldwin brought an evolutionary consideration to bear on Social Heredity. He emphasized the ways in which ideas—including cultural rules, norms and expectations—are transmitted from one generation to the next setting up an alternative, social, mode of inheritance alongside the more widely recognized "physical" inheritance (i.e., germ-line inheritance). In *Mental Development* Baldwin described social heredity as largely independent of physical heredity, with Organic Selection being to Social Heredity what natural selection is to physical heredity. However, in the *New Factor* paper, Baldwin expanded his description of Organic Selection to include how the two modes of inheritance can interact as described in more detail below.

The fusion of culture and evolution has an interesting history in itself. Whilst in the late nineteenth century, Baldwin had little hesitation in offering such a proposition, a number of overtly racist theories of human evolution contributed to a split between the biological sciences (that dealt with evolution, but not culture) and the social sciences (that dealt with culture, but not evolution). Particularly in social anthropology, anxiety about the potentially racist implications of examining the hereditary underpinnings of the human capacity for culture often led to the censoring of any such conjunction (Bloch, 2012) and this division persisted across the twentieth century. Nonetheless, since the 1970s, efforts to unite the two have resumed. The final chapter of Wilson (1975) *Sociobiology* sought to bring human behaviour, including culture, within an evolutionary framework. However, its reception was extremely polarized and drove the subsequent "sociobiology debate". Another attempt to bring evolutionary thinking to the study of culture is Dawkins (1976) notion of "memes" advanced in *The Selfish Gene*. Dawkins' ideas share much with pre-*New Factor* Baldwin, both emphasizing the social transmission of ideas or habits across generations as an inheritance system separate from that of genes. In the hands of Dawkins, intriguing conceptual parallels between genetic transmission across generations and mimetic transmission across generations are proposed. In each case, there is the possibility of preservation and selection, the key differences being the replicator—meme versus gene—that is preserved or selected.

However, unlike Dawkins, Baldwin went on to entertain the possibility of an interaction and not just a parallelism between natural selection and Social Heredity. Thus, the biological capacities underpinning the acquisition of memes could themselves be subject to Organic Selection, facilitating the acquisition of those adaptive social memes by later generations. In *Development and Evolution*, Baldwin (1902) writes that Social Heredity: "keeps certain variations alive, thus sets the direction of ontogenetic accommodation thereby influences the direction of the available congenital variations of the next generation, and so determines

phylogenetic evolution" (p. 103). On this view, we should not conceptualize human evolution in terms of two distinct phases, an earlier phase in which natural selection was at work and a subsequent phase in which, evolutionary change having come to a standstill, historical and cultural change by means of social transmission and diffusion took over. According to Baldwin, social transmission shaped the terms within which natural selection operated—certainly for human beings, and arguably for many other social animals as well.

Perhaps the best fit to Baldwin's thinking comes from the contemporary field known as cultural evolution (Boyd & Richerson, 1985; Mesoudi, 2011). This field includes studies of cultural change separate from genetic change (cultural evolution) as well as how culture influences and is influenced by genetic change (gene-culture coevolution). Reflections of Baldwin's later thinking on the evolution of morality described in his book *Darwin and the Humanities* (Baldwin, 1909) can also be seen in contemporary cultural evolutionary theories of cultural group selection (Henrich, 2004).

However, contemporary cultural evolution takes a more diverse approach to the interactions between culture and genes than does Baldwin's Organic Selection. Whereas Baldwin saw natural selection acting to entrench plastic responses, modern work recognizes that the genetic response to cultural phenomena can be complex and unpredictable as, for example, when the spread of Yam farming in West Africa drove the spread of genes for malaria resistance (Durham, 1991). Even today, Baldwin's conception of the importance of culture to understanding evolution is far from being taken for granted (Dickins & Rahman, 2012; Mesoudi et al., 2013). In arguing for an interaction between social transmission and natural selection, contemporary psychologists are still prone to underline the disconcerting nature of such an interaction—even if Baldwin laid out his claim well over a century ago (Baumeister, 2010).

PIAGET, BALDWIN AND JANET

Ten years after Baldwin had arrived in Paris, and immediately after the First World War, Jean Piaget studied there for two years. He arrived with a range of intellectual interests—in psychoanalysis, in logic and philosophy, and in biology. It was only during his stay in Paris, however, that Piaget began to do empirical work with children. By the time he left Paris in 1921, he had embarked on a career that would make him one of the most influential child psychologists of the century. His writings, even from that initial period, are identifiably Piagetian in their tone and intellectual framework (Harris, 1997). This raises the question of how the 25-year-old Piaget was able to so quickly develop a framework for understanding human mental development that would suffice for the rest of his career.

Three factors likely played a role in enabling Piaget to synthesize a life-long research program in that relatively short, 2-year period. First, his prior familiarity

with psychoanalysis and with the clinical interview, acquired during an earlier stay in Zurich where he listened to lectures by Bleuler and Jung, alerted him to the hidden structures that might underlie the overt replies of a child or of an adult. Second, his training in logic and philosophy sensitized him to the existence of logical or pre-logical structures in the child's thinking—as distinct from the symbolic or affective structures emphasized by psychoanalysis. Third, his training as a biologist led him to think—like Baldwin—about the relationship between ontogenesis and phylogenesis. Indeed, part of Piaget's success came from transposing a key topic from organic phylogenesis—that of transitional forms—to mental ontogenesis, allowing him to ask by what transitional forms does the child shift from one mode of mental organization to another.

Piaget's use of ideas from evolutionary thinking leads to a consideration of how far Piaget was influenced by Baldwin—now in his 60s. In an interview shortly before his death, Piaget (1982) maintained he never actually met Baldwin. However, Piaget also said that this was because Baldwin was already dead, which is certainly inaccurate. This, plus their overlap both in Paris and Geneva (where Baldwin visited Piaget's immediate employer, Claparède) makes it feasible that they met. Regardless, Piaget certainly read several of Baldwin's books and discussed his ideas with his mentor in Paris Pierre Janet, a student of Charcot and professor of experimental and comparative psychology at the Collège de France (Piaget, 1982). Baldwin and Janet met regularly. They shared a progressive conception of mental development, one in which later stages were viewed as based upon, but progressing beyond, the achievements of earlier stages (Richards, 1987; Wozniak, 2009). More broadly, they shared the belief that, in certain key respects, ontogenetic development recapitulates phylogenetic development. In discussing his stay in Paris, Piaget refers to Janet's lectures at the Collège de France, including his discussions of stages of development (Piaget, 1975); he also reported that Baldwin was an important influence on Janet (Vonèche, 1982). It is likely that their combined influence, including their belief in recapitulation, helped consolidate in Piaget's mind the thesis that ontogenetic development can be analyzed in terms of successive forms of organization (i.e., cognitive stages) and that later forms are better adapted—or better equilibrated—with respect to reality than are earlier forms (Wozniak, 2009).

In addition to these broad influences, it is plausible that Piaget was directly influenced by Baldwin's ideas about Organic Selection. When he returned from Paris to Switzerland and conducted his doctoral work on freshwater snails (*Limnaea stagnalis*), Piaget observed that a less elongated shell developed if snails were raised in turbulent waters, the shorter shell being better adapted to such conditions (Piaget, 1929). More specifically, the contraction of the columnar muscles allowed snails to adhere to the lake substrate and in turn that change appeared to lead to a reduced growth of the shell. Importantly, this plastic adaptation gradually became a hereditary fixation in that when these snails were subsequently bred in still water, they continued to produce the less elongated

shell. In Baldwin's terms, Organic Selection had entrenched an adjustment that had started off as a developmental accommodation.

Despite this obvious parallel between Baldwin's ideas and Piaget's doctoral research with molluscs, Piaget was disinclined to acknowledge that Baldwin had had a pervasive or fundamental influence on his theory of cognitive development (Piaget, 1982; Vonèche, 1982). Piaget's assessment is probably correct. Piaget's lifelong research program—already discernible after his stay in Paris—focused on the child as an autonomous thinker, especially with respect to the physical world of space, quantity, speed and time. Piaget mostly ignored the child's capacity for social and cultural learning. By implication, even if Piaget was influenced by Baldwin's ideas regarding Organic Selection in thinking about the shells of molluscs, there is little indication in Piaget's theorizing that he assimilated Baldwin's ideas about Social Heredity or the potential interaction between Social Heredity and Organic Selection in thinking about human development and evolution. More specifically, there is little indication in Piaget's theory that children might be biologically designed to navigate within a cultural world. Indeed, it is only recently that we have begun to recognize that children are, so to speak, natural anthropologists, endowed with a biological capacity for learning how to interpret and understand a particular cultural world—or indeed, several, distinct cultural worlds (Harris, 2012). They are not simply gifted natural scientists who construct an understanding of the underlying regularities of the physical world—even if this was Piaget's primary focus.

Baldwin in contemporary perspective

Although Baldwin's influence on Piaget seems somewhat modest, the resurgence of interest in the evolutionary implications of culture documented above might seem to suggest a strong legacy for Baldwin within human evolutionary biology. However, it is unclear whether this is a case of direct descent, as opposed to convergence, in thinking. In the course of writing this manuscript, we asked several founders of modern cultural evolutionary theory about the influence Baldwin had on their own work. In all cases, the response was that they only came across Baldwin well after the development of their own ideas and only a minority of the literature they cited as influential referenced any of Baldwin's work. Consistent with this, and despite their provocative nature, Baldwin's proposals received little attention across the early twentieth century. Richards (1987) argues that this is in part due to his professional disgrace leading to the treatment of much of his work with suspicion. However, it is also true that the re-discovery and integration of Mendelian inheritance within mainstream Darwinian theorizing pushed other modes of inheritance, such as Baldwin's Social Heredity, to the side. More specifically, Mendel's laws offered a strong counter to the challenges to orthodox Darwinian theory that had been mounted by Lamarckian researchers interested in the potential impact of ontogenetic

adaptation on the course of evolution (Vonèche, 1982). Such a counter appeared to render Baldwin's speculative proposals unnecessary. After this, Baldwin's work was further excluded by the distinction between proximate and ultimate causation in biology (Mayr, 1961). This separated development (considered part of proximate explanations) from evolution (the ultimate explanation), meaning that Baldwin's ideas could not be easily accommodated within the framework of the Modern Synthesis.

Nevertheless, more than a century later, the ideas set out in Baldwin's 1896 paper and his book *Development and Evolution* are once again receiving serious attention as shown by a recent edited volume discussing Baldwin's legacy (Weber & Depew, 2007), a sensitive reconstruction of how Baldwin's proposals emerged timed to coincide with the bi-centennial celebrations of Darwin's birth (Wozniak, 2009) and a memorial tribute to Baldwin's paper in the journal in which it had first appeared, the *American Naturalist* (Scheiner, 2014). Below, we discuss two areas of contemporary biological research in which discussion of Baldwin remains widespread.

One contemporary area of research that draws on Baldwin's thinking concerns the ability of developmental plasticity to accelerate evolution. The instigating work in this case was a 1987 paper by Geoff Hinton and Steven Nowlan (Hinton & Nowlan, 1987). They used evolutionary simulations to show that in cases where adaptive evolution is reliant on an extremely unlikely series of mutations, plasticity can bridge this gap, rapidly identifying the appropriate behaviour and accelerating the relevant genetic changes. Lauren Ancel Meyers furthered this work with two additional papers. The first showed that when plasticity itself can evolve, periods of environmental change favour increases in plasticity enabling organisms to cope with novel challenges (Ancel, 1999), as predicted by Baldwin. However, as predicted by critics of Baldwin, once the environment has been stable for a number of generations, plasticity is lost. The second paper (Ancel, 2000) addressed another criticism of Baldwin's work; if plasticity enables organisms to be successful, why is there a need for any genetic change at all? Ancel Meyers showed that the efficacy of plasticity does indeed reduce the need for a genetic response; whilst she found that plasticity accelerates the initial discovery of a novel trait, it actually slows the genetic fixation of that trait because modest genetic change combined with plasticity often means that the trait is extremely likely to be acquired and so there is little selective advantage to further genetic change. Collectively, these papers lend support both to Baldwin's suggestion that learning was at the leading edge of phenotypic change, but also to Baldwin's critics who identified inconsistencies in Baldwin's theories.

Another topic in which Baldwin features regularly concerns the evolution of language. This is largely due to two, somewhat different, approaches to the evolution of language, both of which invoked Baldwin. The first is the account proposed by Pinker and Bloom (1990) in which language arises following a genetic change that facilitated it. The Baldwin Effect was used to explain how

this mutation could spread from a single individual when they were the only individual in possession of the mutation. The argument was that although only the mutant could discover language, they would still have some success in sharing this discovery with their less articulate brethren and so would still gain some benefit (and more so than the others who would struggle to acquire language). Thus, the language would start as a mutation, spread as a plastic response and then the mutation would spread to assist in the learning process.

Whilst this pattern of plasticity being replaced by genetic influence is in line with Baldwin's thinking, language originating with a genetic mutation is considerably less so. Baldwin's "mind first monism" led him to favour plasticity as the originator of novel traits, a theme he develops in *Darwin and the Humanities* where he argues that many complex social behaviours are underpinned by social, and not genetic, inheritance. This idea is more apparent in the second theory of the evolution of language, proposed by Deacon (1997). In this case language starts as a cultural innovation reliant on our ancestors' general cognitive abilities. All genetic change is subsequent to this and in response to the nature of the language, which would itself continue to evolve. Building on this, other work has explored the type of genetic response we might expect following the cultural evolution of language. Collectively, these studies suggest that only highly stable features of language are likely to come under genetic influence (Chater, Reali, & Christiansen, 2009; Christiansen, Reali, & Chater, 2011) and that this will occur only if the resulting changes do not impair our performance on other cognitive tasks (Reali & Christiansen, 2009).

CONCLUSION

In *Mental Development*, Baldwin stressed that the success of ideas hinged as much on their compatibility with the cultural environment in which they existed, as their veracity. Ironically, evidence for this can be seen in the trajectory of Baldwin's own theories, which were rapidly replaced by alternatives more amenable to empirical documentation and mathematical description and, arguably, less associated with unacceptable conduct by the researcher. Whilst the reappearance of evolutionary thinking concerning culture might seem to be resurrection of Baldwin's work, it largely appears to be a case of convergent evolution. Nonetheless, modern researchers are becoming increasingly aware of Baldwin's contributions. The addition of Organic Selection to the cultural landscape of contemporary science is helping to drive research into the interactions between development and evolution.

Manuscript received 1 June 2015
Revised manuscript accepted 14 July 2015
First published online 30 October 2015

REFERENCES

Ancel, L. W. (1999). A quantitative model of the Simpson–Baldwin effect. *Journal of Theoretical Biology*, *196*, 197–209. doi:10.1006/jtbi.1998.0833

Ancel, L. W. (2000). Undermining the Baldwin expediting effect: Does phenotypic plasticity accelerate evolution? *Theoretical Population Biology*, *58*, 307–319. doi:10.1006/tpbi.2000.1484

Baldwin, J. (1890). Recent discussion in materialism. *The Presbyterian and Reformed Review*, *3*, 357–372.

Baldwin, J. (1909). *Darwin and the humanities*. Baltimore, MD: Review.

Baldwin, J. M. (1895). *Mental development in the child and the race*. New York, NY: Macmillan.

Baldwin, J. M. (1896). A new factor in evolution. *The American Naturalist*, *30*, 441–451 and 536–553.

Baldwin, J. M. (1897). *Social and ethical interpretations in mental development*. New York, NY: Macmillan.

Baldwin, J. M. (1902). *Development and evolution*. New York, NY: Macmillan.

Baumeister, R. F. (2010). The human mind and the evolution of cultural animals. In M. Schaller, A. Norenzayan, S. J. Heine, T. Yamagishi, & T. Kameda (Eds.), *Evolution, culture and the human mind* (pp. 23–38). New York, NY: Psychology Press.

Bloch, M. (2012). *Anthropology and the cognitive challenge*. Cambridge: Cambridge University Press.

Boyd, R., & Richerson, P. J. (1985). *Culture and the evolutionary process*. Chicago, IL: University of Chicago Press.

Chater, N., Reali, F., & Christiansen, M. H. (2009). Restrictions on biological adaptation in language evolution. *Proceedings of the National Academy of Sciences of the United States of America*, *106*, 1015–1020. doi:10.1073/pnas.0807191106

Christiansen, M. H., Reali, F., & Chater, N. (2011). Biological adaptations for functional features of language in the face of cultural evolution. *Human Biology*, *83*, 247–259. doi:10.3378/027.083.0206

Dawkins, R. (1976). *The selfish gene*. Oxford: Oxford University Press.

Deacon, T. W. (1997). *The symbolic species: The co-evolution of language and the brain*. New York, NY: W. W. Norton.

Dennett, D. (2003). The Baldwin effect: A crane, not a skyhook. In B. H. Weber & D. J. Depew (Eds.), *Evolution and learning: The Baldwin effect reconsidered* (pp. 69–79).Cambridge, MA: MIT Press.

Dickins, T. E., & Rahman, Q. (2012). The extended evolutionary synthesis and the role of soft inheritance in evolution. *Proceedings of the Royal Society B: Biological Sciences*, *279*, 2913–2921. doi:10.1098/rspb.2012.0273

Durham, W. H. (1991). *Coevolution: Genes, culture and human diversity*. Stanford, CA: Stanford University Press.

Harris, P. L. (1997). Piaget in Paris: from “autism” to logic. *Human Development*, *40*, 109–123. doi:10.1159/000278711

Harris, P. L. (2012). *Trusting what you’re told: How children learn from others*. Cambridge, MA: The Belknap Press/Harvard University Press.

Henrich, J. (2004). Cultural group selection, coevolutionary processes and large-scale cooperation. *Journal of Economic Behavior & Organization*, *53*, 3–35. doi:10.1016/S0167-2681(03)00094-5

Hinton, G., & Nowlan, S. (1987). How learning can guide evolution. *Complex Systems*, *1*, 495–502.

Mayr, E. (1961). Cause and effect in biology. *Science*, *134*, 1501–1506. doi:10.1126/science.134.3489.1501

Mesoudi, A. (2011). *Cultural evolution: How Darwinian theory can explain human culture and synthesize the social sciences*. Chicago, IL: University of Chicago Press.

Mesoudi, A., Blanchet, S., Charmantier, A., Danchin, É., Fogarty, L., Jablonka, E., … Pujol, B. (2013). Is non-genetic inheritance just a proximate mechanism? A corroboration of the extended evolutionary synthesis. *Biological Theory*, *7*, 189–195. doi:10.1007/s13752-013-0091-5

Morgan, C. L. (1896). On modification and variation. *Science*, *4*, 733–740. doi:10.1126/science.4.99.733

Morgan, T. J. H. (in press). Testing the cognitive and cultural niche theories of human evolution. *Current Anthropology.*

Osborne, H. F. (1896). A mode of evolution requiring neither natural selection nor the inheritance of acquired characteristics. *Transactions of the New York Academy of Science*, *15*, 141–148.

Piaget, J. (1929). Les races lacustres de la "Limnaea stagnales": Recherches sur les rapports de l'adapatation hereditaires avec le milieu [Lacustrine lineages of "Limnaea stagnales": Research on the relationship between hereditary adaptation and the environment]. *Bulletin Biologique de la France et la Belgique*, *63*, 424–455.

Piaget, J. (1975). L'intelligence selon Alfred Binet [Intelligence according to Alfred Binet]. *Société Alfred Binet et Théodore Simon. Psychologie de l'enfant et pédogogie expérimentale*, *75*, 106–119.

Piaget, J. (1982). Reflections on Baldwin: An interview conducted and introduced by J. Jacques Vonèche. In J. M. Broughton & D. J. Freeman-Moir (Eds.), *The cognitive developmental psychology of James Mark Baldwin: Current theory and research in genetic epistemology* (pp. 80–86). Norwood, NJ: Ablex Publishing Corporation.

Pinker, S., & Bloom, P. (1990). Natural language and natural selection. *Behavioral and Brain Sciences*, *13*, 707–784. doi:10.1017/S0140525X00081061

Reali, F., & Christiansen, M. H. (2009). Sequential learning and the interaction between biological and linguistic adaptation in language evolution. *Interaction Studies*, *10*, 5–30. doi:10.1075/is.10.1.02rea

Richards, R. J. (1987). *Darwin and the emergence of evolutionary theories of mind and behavior*. Chicago, IL: The University of Chicago Press.

Scheiner, S. B. (2014). The Baldwin effect: Neglected and misunderstood. *American Naturalist*, *184*, ii–iii. doi:10.1086/677944

Simpson, G. G. (1953). The Baldwin effect. *Evolution*, *7*, 110–117. doi:10.2307/2405746

Vonèche, J. (1982). Evolution, development and the growth of knowledge. In J. Broughton & D. Freeman-Noir (Eds.), *The cognitive-developmental psychology of James Mark Baldwin* (pp. 51–79). Norwood, NJ: Ablex Publishing Corporation.

Weber, B. H., & Depew, D. J. (2007). *Evolution and learning: The Baldwin effect reconsidered*. Cambridge, MA: Bradford Press MIT.

West-Eberhard, M. J. (2003). *Developmental plasticity and evolution*. Oxford: Oxford University Press.

Wilson, E. O. (1975). *Sociobiology: The new synthesis*. Cambridge, MA: Harvard University Press.

Wozniak, R. H. (1982). Metaphysics and science, reason and reality: The intellectual origins of genetic epistemology. In J. M. Broughton & D. J. Freeman-Moir (Eds.), *The cognitive developmental psychology of James Mark Baldwin: Current theory and research in genetic epistemology* (pp. 13–45). Norwood, NJ: Ablex Publishing Corporation.

Wozniak, R. H. (2009). Consciousness, social heredity, and development: The evolutionary thought of James Mark Baldwin. *American Psychologist*, *64*, 93–101. doi:10.1037/a0013850