[James Mark] Baldwin and His Many Effects

David J Depew, University of Iowa
Life and Mind: Philosophical Issues in Biology and Psychology
Kim Sterelny and Rob Wilson, editors

Cycles of Contingency: Developmental Systems and Evolution
Susan Oyama, Paul E. Griffiths, and Russell D. Gray, editors, 2000

Coherence in Thought and Action
Paul Thagard, 2000

Norms of Nature: Naturalism and the Nature of Functions
Paul Sheldon Davies, 2001

The New Phrenology: The Limits of Localizing Cognitive Processes in the Brain
William R. Uttal, 2001

Evolution and Learning: The Baldwin Effect Reconsidered
Bruce H. Weber and David J. Depew, editors, 2003
1 Introduction: The Very Idea of the Baldwin Effect

In recent years, a number of evolutionary theorists have spoken well of a turn-of-the-twentieth-century idea that since the nineteen fifties has gone by the name of “the Baldwin effect” (Hinton and Nowlan 1987; Dennett 1995; Deacon 1997). The general thrust of the idea is to urge that, under some conditions, learned behaviors can affect the direction and rate of evolutionary change by natural selection. In such cases, cultural inheritance of a learned behavior across an indefinite number of generations creates a “breathing space” (Godfrey-Smith, chap. 3, this volume) in which inherited factors favorable to the adaptive behavior in question that either already exist, happen to crop up, or can be stimulated by the change in question—there is some dispute about this—will move along the channel already cut by culture, thereby converting learned behaviors into genetic adaptations or, alternatively, supporting learned behaviors by related genetic adaptations. In either case, natural selection will have ratified evolutionary vectors that learning began.

It was George Gaylord Simpson who in a 1953 article gave the Baldwin effect the name it has borne ever since (Simpson 1953). He named it after James Mark Baldwin, an American child psychologist who claimed to have introduced the idea in articles appearing in a paper given in late 1895 and in publications in the American Naturalist and Science in 1896 (Baldwin 1896a,b). The Baldwin effect might just as easily, however, have been called the “Lloyd Morgan effect.” For the British animal ethologist Conwy Lloyd Morgan, who addressed academic audiences in the United States during winter of 1895–1896, proposed the same idea in a paper delivered
For that matter, the hypothesis might also have been called “the Osborn effect,” after the American paleontologist H. F. Osborn, who, also in 1896, published a paper that he titled “A Mode of Evolution Requiring Neither Natural Selection Nor the Inheritance of Acquired Characteristics” (Osborn 1896).

The subsequent fortunes of the Baldwin effect have varied considerably. Julian Huxley was a Baldwin booster in *Evolution: The Modern Synthesis* (Huxley 1942: 114). Simpson, by contrast, was something of a Baldwin skeptic. In his 1953 articles, he admitted that the idea is theoretically coherent, that is, not inconsistent with the fundamental principles of the Modern Evolutionary Synthesis. But Simpson doubted whether the alleged effect is empirically instantiated very often, and, if it is, whether this can be definitively shown. By the early sixties, a deeper skepticism had set in. In *Animal Species and Evolution*, Ernst Mayr recommended “discarding this concept altogether” as either a trivially true example of normal natural selection at work or a flatly false regression to Lamarckism (Mayr 1963: 611).

Against this mid-century hostility, it is striking a rather diverse lot of contemporary evolutionary theorists, most of whom regard themselves as supporters of the Modern Synthesis, have of late become “Baldwin boosters.” One reason is not hard to find. In contrast to the original Baldwin boosters, who were interested in saving some aspects of Lamarckism in the wake of the post-Weismannian turn to hard inheritance, but who differed from one another about what and how much to save, today’s Baldwin boosters are typically evolutionary psychologists who are searching for scenarios in which a population can get itself by behavioral trial and error onto a “hard-to-find” part of the fitness landscape in which human brain, language, and mind can rapidly co-evolve. They are searching for what Daniel Dennett, a Baldwin booster, calls an “evolutionary crane,” an instrument to do some heavy lifting fast. What Dennett calls “a Good Trick”—potato washing initiated by an individual, perhaps, which is subsequently spread by imitation among a population of monkeys—can serve as such an evolutionary crane so long as gene frequencies also change in a way that supports the behavior (Dennett 1991, 1995).

The concerted flurry of interest in the Baldwin effect that first manifested it during the mid-century has seemed to have petered out. The attention of those who, like Dennett, are looking for mechanisms for rapid evolution was first turned to “Baldwinesque” scenarios by a series of publications that appeared in 1987. The most important of these was G. E. Hinton and S. J. Nowlan’s “How Learning Can Guide Evolution,” which, in the course of reporting on genetic algorithms that seemed to do precisely what the title of their paper suggested, not only referenced Baldwin’s 1896 papers, but claimed that Baldwin had already demonstrated what their computer simulations now illustrated (Hinton and Nowlan 1987; see also Ackly and Littman 1992; and Puentedura, chap. 11, this volume). Equally significant was the fact that John Maynard Smith, doyen of contemporary British Darwinian, not yet chastened by the scorn he subsequently displayed for treating simulations of complex adaptive systems as actual biological knowledge, gave his blessing to Hinton and Nowlan’s results in an article in *Nature* in October of the same year (Maynard Smith 1987). The year 1987 also saw the publication of Robert Richards’ *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior*, which gave a lucid account of the Baldwin effect in its original setting (Richards 1987). The concerted flurry of interest in the Baldwin effect that first manifested itself in 1987 apparently stimulated Dennett to endorse the idea in *Consciousness Explained* (1991) and later in his best-selling tract *Darwin’s Dangerous Idea* (1995). Dennett implies that the orthodoxy of the Baldwin effect had never been in much doubt, and that even if it had been, “Hinton and Nowlan and Maynard Smith have shown clearly and succinctly how and why it worked,” thereby rendering the Baldwin effect “no longer a controversial wrinkle in orthodox Darwinism” (Dennett, chap. 4, this volume). Terrence Deacon too has made significant use of what he takes to be Baldwinian themes in his *The Symbolic Species* (Deacon 1997). As we will see, however, his approach differs from Dennett’s.

In this chapter, I propose to elicit some reasons why the very idea of the Baldwin effect appeared promising in its original setting, increasingly unpromising to the founders of the Modern Synthesis, and why in recent years it has seemed promising once again. I will do so by reconstructing the arguments of the original Baldwin boosters, their mid-century critics, and contemporary advocates in terms of the quite different theoretical assumptions that each party took, or takes, for granted. My claim will be that the history of the general idea that “learning guides evolution by natural selection” reveals that the Baldwin effect does not reliably refer either to a
theory-neutral empirical phenomenon, or to a single hypothesis, or to an identifiable mechanism, and that these facts explain why the Baldwin effect has been so diversely received. Because it has never been shown to be a theory-neutral phenomenon, articulations and assessments of the general idea depend on different contrasts and on different, often contradictory, theoretical backgrounds. They depend, in the first instance, on what you are arguing against—Lamarckism, for example, or slow-poke balancing selection. But they also depend on what brand of Darwinism you are presupposing. It is possible that the Darwinian frameworks of today's Baldwin boosters differ from Simpson's by about as much as Simpson's differed from Baldwin's or Lloyd Morgan's. If so, it should come as no surprise that characterizing the Baldwin effect, deducing it from principles, verifying it in fact, explaining how it works, and recommending it depends primarily on a variety of shifting and contested theoretical ideas.

Let me add that I do not say this in order to join forces with Baldwin skeptics. The reasons that deter me from becoming a Baldwin booster on Baldwin's terms also deter me from becoming a Baldwin skeptic on the word of anyone who simply presupposes Simpson's or Mayr's assumptions. Admittedly, I would hate to buy into the contemporary enthusiasm for Baldwinism if it commits me to an unacceptable explanatory scheme. On the other hand, I would hate to have a good idea go unused simply because it does not fit a presupposed theoretical framework. For as many philosophers and historians of science have shown, it is as profitable under some conditions to call a conceptual scheme into question as it is to dismiss an idea for its lack of fit with received assumptions (Lakatos 1970; Laudan 1977).

2 Baldwin's Baldwin Effect—and Lloyd Morgan's Too

Baldwin's argument for the Baldwin effect has the following steps:

1. In the course of their life-cycles, "excess," "overproduced," largely random, movements and behaviors of organisms are shaped into adaptive habits by a process of selective reinforcement under the influence of physical, neurological, and "intelligent" forces, the latter including imitation, reinforcement by pleasure and pain, and in some cases means-end reasoning. (Baldwin calls these "ontogenetic adaptations."

2. Ontogenetic adaptations adapt the inherited instincts that permit them to environmental contingencies.

3. Ontogenetic adaptations enhance the life chances of the organisms that possess them by making them more responsive to the challenges of contemporary environments. The more ontogenetically adapted an organism, the more it can "stand the stress and storm" of environmental challenge and "rise to the occasion" (Baldwin 1896c: 445, 443).

4. The more ontogenetically adapted an organism, the greater the probability that it will leave offspring. ("This sort of adaptation on the part of the creature keeps the creature alive by supplementing his reflex and instinctive actions, and so prevents the operation of natural selection itself" [Baldwin 1896c: 440]).

5. In some species, ontogenetic adaptations are made more effective by "social heritability." ("By imitation the little animal picks up directly the example, instruction, mode of life, etc. of his private family circle and species" [Baldwin 1896c: 440].)

6. Socially heritable ontogenetic adaptations can be maintained indefinitely in a population until germinal elements that coincide with their influence turn them into congenital instincts.

7. Newly evolved congenital instincts provide a platform for further ontogenetic adaptation.

Baldwin used the phrase "organic selection" to refer to the process by which an organism "selects" spontaneous movements and behaviors so that they form ontogenetic adaptations, or what he sometimes called "individual accommodations" (Steps 1 and 2). In Mental Development in the Child and the Race, and in his subsequent papers, he used the notion that organisms select movements and behaviors in accord with environmental rewards and punishments in order to find a mean between Spencer's stress on the role of an impinging environment in physically conforming the organism to its environment and the neo-Lamarckians' tendency to think of instincts as "lapsed intelligence," that is, as the residual effects of conscious choice (Baldwin 1895, 1896a). The former, even when it works on "over-produced" nervous discharges, renders organisms too passive to account for the fact that they learn; the latter treats them as too active in a rational, means-end way. Baldwin called attention to the interplay between novel adaptive responses and preformed congenital instincts by his careful observation of the ways in which the young are instinctively prone to imitate parents and other adults, while at the same time parents and other adults, who
form a large part of the neonate’s environment, encourage some movements and behaviors and discourage others.1

In a paper delivered to the New York Academy of Sciences in February 1896, and in articles published later in the same year (Baldwin 1896b,c), Baldwin asserted that “organic selection” is also a “new factor in evolution.” The social heritability of learned behaviors that intensifies and preserves ontogenetic adaptations opens up a transgenerational “breathing space” in which, through the action of natural selection working on whole organisms, ontogenetic adaptations will eventually be fixed by germ-line shifts that reduce the contingencies to which a presumably adaptive learned space” in which, through the action of natural selection working on whole organisms, ontogenetic adaptations will eventually be fixed by germ-line shifts that reduce the contingencies to which a presumably adaptive learned behavior is exposed. This process is a “new factor in evolution” not only because it explains the formation of congenital instincts that support ontogenetic adaptations, but because it putatively constitutes the leading edge of evolutionary change more generally. In opening the way to further ontogenetic adaptations, organic selection is an engine of phylogenetic progress.

Baldwin was eager to assert that he had already discerned the phylogenetic implications of organic selection in his 1895 book in order to lay a claim of priority for this idea over Lloyd Morgan and Osborn. As both Richards and Paul Griffiths point out, however, Baldwin could do so only by overlooking statements he had explicitly made in 1895 to the effect that the organic selection of behaviors by individual organisms across a series of generations is neutral between Weismannian hard inheritance and neo-Lamarckian soft inheritance (Griffiths, chap. 10, this volume; Richards 1987: 488). Nor could he have used anything in his 1895 book as the basis for such an argument. For the only relatively clear reasons that Baldwin and his contemporaries ever gave for thinking that phylogenetic shifts will predictably move in the direction first marked out by Baldwin’s ontogenetic adaptations depend on August Weismann’s hard account of inheritance, which was not only inconsistent with Lamarckism, but was apparently suggested to Baldwin by Lloyd Morgan in 1896 (Richards 1987: 493).

So-called simultaneous discoveries are, I suppose, like that. Nevertheless, it is not hard to understand why a simultaneous discovery of this sort would have occurred in the mid 1890s. Baldwin, Lloyd Morgan, and Osborn were all responding to the same exigency—the appearance in the 1880s of Weismann’s empirical proof, as it was almost universally taken to be, that traits acquired by an organism in its lifetime could not be passed directly to offspring.2 What made this observation compelling was its connection to a causal mechanism, namely, the early developmental sequestering of germ line cells—those original “immortal replicators”—from somatic cells. This explanation had a revolutionary effect on evolutionary thought. It instantly broke the connection between Darwinism and evolutionary mechanisms other than natural selection that Darwin himself had sought to keep open. Darwinism henceforth meant “neo-Darwinism,” namely, the claim that evolutionary change was to be based exclusively on natural selection and that natural selection was to be based exclusively on hard inheritance. The origins of the Baldwin effect lie in the sudden need of “Darwinians” in the widest sense, as well as neo-Lamarckians like Osborn, either to bring their leading ideas into conformity with this set of parameters or perish. Spencerian Social Darwinism, for example, hitherto a leading account of the evolutionary process, more or less perished on the spot, or at least retreated to the redoubts of popular ideology.

Osborn provides an example of the panic induced by Weismannism. The sudden ascendancy of hard inheritance and the all-sufficiency of natural selection stimulated him to find a way to protect his directional, progressivist, endogenously-driven view of the evolutionary process (“aristogenesis”) without relying quite as directly as he had on the heritability of characteristics acquired by intelligence and effort (Osborn 1896). Unlike his fellow neo-Lamarckian Edward Drinker Cope, however, who attempted to refute Baldwin simply by claiming that “it is impossible to believe that Weismann’s doctrine is true” and by reasserting strenuously that “Lamarckism is true” (Cope 1896: 430), Osborn thought that his version of organic selection evaded both the direct inheritance of acquired characteristics and Darwinian natural selection.

In view of Osborn’s neo-Lamarckian flirtation with something like organic selection, it is of great importance to recognize that the Baldwin effect attracted Baldwin and Lloyd Morgan for quite different reasons. Like Weismann, they were proud to call themselves Darwinians not only in the wide evolutionary sense, but in the selectionist sense as well, although like everyone else they had hitherto not distinguished very clearly between hard and soft inheritance and in some cases had to be dragged kicking and screaming to the cause. Like William James, a fellow Darwinian psychologist, they now rejoiced that Weismann’s “neo-Darwinism” strengthened the hand of natural selection against Darwinism’s evolutionary rivals in explaining the origin of instincts (James 1890: 684). Like James too, Baldwin
and Lloyd Morgan were delighted that Weismannism afforded them a way of pillorying Herbert Spencer, who thought of something like germ-line adaptations as arising in a single generation from the direct effects of an impinging environment combined with the direct heritability of characteristics acquired in this brute way (James 1890: 686; Baldwin 1896a,b,c; Lloyd Morgan 1896a,b,). Lloyd Morgan and Baldwin were especially delighted to be able to accuse Spencerians and neo-Lamarckians alike of being, paradoxically, extreme “naturists,” since the view that acquired characteristics are immediately heritable implied a loss of phenotypic flexibility. “Such inheritance would tend to bind up the child’s nervous substance in fixed form that he [sic] would have less or possibly no plastic substance left to learn with” (Baldwin 1902: 55; see Hoffmeyer and Kull, chap. 13, this volume).

In arguing that organic selection is a “new factor in evolution,” both Baldwin and Lloyd Morgan asserted nonetheless that there is a natural tendency for a learned trait to become phylogenetically entrenched or supported as a learned trait. Indeed, Baldwin and Lloyd Morgan thought that something even stronger must be true, namely that “the direction at each stage of a species’ development must be in the direction ratified by intelligence” (Baldwin 1896c: 447-448, my italics). To discover why Lloyd Morgan, followed it would seem by Baldwin, came to this conclusion, we must first sketch in a bit more detail about the sort of Darwinism to which they subscribed. To do so, we must see how they understood not only organic selection, but also natural and germinal selection.

Natural Selection
Organic selection, even when it is considered as a “new factor in evolution,” is contrasted with “the natural selection of whole organisms” (Baldwin 1896c: 445, n. 3). Rather than a creative force that accumulates the results of many generations of small directional changes, natural selection is for Baldwin and Lloyd Morgan a negative, rather indiscriminate, force. It illustrates well what one wag has called “the fly-swatter theory of natural selection.” It sentences whole organisms that cannot compete for scarce resources to death without issue. Baldwin wrote:

If we suppose, at first, organisms capable of reacting to stimulations…we may suppose the stimuli to which they react to be some beneficial and some injurious. If the beneficial ones recur more frequently to some organisms, these would live rather than others… The former would therefore be selected…This is the current Darwinian position. (Baldwin 1902: 163)

To reinforce the view that this was indeed the “current Darwinian position” in these years, consider the following passage from Lloyd Morgan:

Now, what is natural selection, at any rate as understood by the master—Darwin? It is a process whereby, in the struggle for existence, individuals possessed of favorable and adaptive variations survive and pass on their good seed, while individuals possessed of unfavorable variations succumb—are sooner or later eliminated, standing therefore a less chance of begetting offspring. (Lloyd Morgan 1896b: 735)

Modern Darwinians will doubtless be disconcerted by Baldwin’s and Lloyd Morgan’s conception of natural selection, and by their ascription of this view to “the master.” Natural selection as conceived by the Modern Synthesis, and in its view by Darwin as well, does not consist in swatting down whole organisms, but in pumping up slightly divergent reproductive rates. It is not, or not crucially, negative selection of whole organisms, but positive, creative selection for minutely discriminated traits carried by organisms and underwritten by genes. On the modern view, you do not have to die young if you belong to a population whose phenotypic traits are being selected against. You merely have to be part of a population with a statistically lower reproductive output than a relevant comparison population. Baldwin and Lloyd Morgan do not share this view.

Germinal Selection
Baldwin’s notion of “organic selection” is also intended to mark a contrast with Weismann’s notion of “germinal selection,” that is, with the differential survival of germ-line variants as they struggle in utero for scarce maternal resources. Germinal selection, not natural selection, is for Weismann the creative force in evolution. It protects hard inheritance by working exclusively on the sequestered germ line; and it conforms to the demand that natural selection must be “all-powerful” by ensuring that nothing that an organism can do in its lifetime to affect its external environment, or be stimulated by its parents to do, can stay the unforgiving demands of natural selection. That is because the organism itself rather than the external world constitutes the environment in which germinal selection occurs.

Using these three concepts—organic, natural, and germinal selection—Baldwin and Lloyd Morgan argued that organic selection, wherever it
occurs, must form the leading edge of evolution by natural selection both within species and between them. It is Lloyd Morgan, however, who is much clearer on this point, and who probably instructed Baldwin that “the incidence of natural selection” has an effect in moving evolution in the direction pointed by organic selection. Germinal selection, Lloyd Morgan noted in Habit and Instinct, is not necessarily correlated to the natural selection of whole organisms at the organism-environment interface (Lloyd Morgan 1896a). There can, accordingly, be a variety of possible relationships between the three kinds, or, if you will, levels, of selection. Lloyd Morgan argues that there are three, and only three, such possible relationships when the organism-environment interaction is mediated by the organic selection of ontogenetic adaptations and the incidence of negative natural selection.

(i) Germinal selection can occur in a way that opposes the direction of individual accommodations or ontogenetic adaptations. In this case, more effort will have to be poured into learning to compensate for what is going on at the germinal level. This will involve a greater expenditure of energy and a greater vulnerability to contingencies. This in turn entails a greater likelihood that the effort will fail at some point, and that individuals and populations bearing such inherited factors will be swatted down by negative natural selection. As Lloyd Morgan puts it, “Any congenital variations antagonistic in direction to [organic] modifications will tend to thwart them and render the organisms in which they occur liable to elimination” (Lloyd Morgan 1896a: 320).

(ii) There might be a neutral relationship between germinal and organic selection, in which neither supports nor hinders the other. In this case, there will be no correlation at all between the two levels. Both will go their merry way, the former at the germ line level, the latter at the level of culture. So the case is irrelevant to questions about the effect of learning on adaptive and evolutionary vectors.

(iii) If, finally, germinal variants are fixed in the germ line in a way that coincides with the direction of learned behavior, the adaptive behavior will be reinforced by inherited factors.

Lloyd Morgan writes:

By their innate plasticity the several parts of an organism implicated by their association with the varying parts are modified in individual life in such a way that their modifications co-operate with germinal variation in producing an adaptation of a double-origin, partly congenital, partly acquired. The organism then waits, so to speak, for a further congenital variation, when a like process of adaptation again occurs. Thus race progress is effected by a series of successive variational steps, assisted by a series of cooperating individual modifications. (Lloyd Morgan 1896a: 315)

Assuming the relevant definitions of key concepts, what Lloyd Morgan is describing is a logically valid inference to a win-win situation. The scythe of natural selection will eventually shift the populational mean in successive generations toward a situation that makes the behavior in question more widespread in the population and screens off any contrary tendencies that may originate in the sphere of germinal selection. In the long run only the germinal elements that reinforce the direction of organic selection by increasing its heritability are retained “because natural selection kills off the others” (Baldwin 1896b: 447). Baldwin’s inference that “the future development at each stage of a species’ development must be in the direction ratified by intelligence,” where intelligence means a variety of ways of responding flexibly to environmental contingencies, including anticipation of likely consequences, is thus grounded in an argument that eliminates any other possibility. Note that on this view no violation of Weismann’s injunctions against the inheritance of acquired characteristics will have been incurred. Nonetheless, the agency-accentuating effects that had hitherto been monopolized by Lamarckism, some of which Baldwin and Lloyd Morgan are concerned to preserve, would have been reaffirmed within a decidedly Darwinian framework. Note too that Baldwin and Lloyd Morgan are not arguing that a phenotype is driven into the genotype. Their idea is that germinal and organic selection coincide to evolve a congenital instinct that is stable enough to buffer the organism’s efforts to respond to environmental pressures, but at the same time open enough to allow further modification by ontogenetic adaptation. What we would call a feedback loop between instincts and behaviors has been expanded to embrace a wider loop between organisms that are ontogenetically adapted and the arrow of evolution.

3 The Baldwin Effect and the Modern Synthesis

The original explanatory framework in which the Baldwin effect was formulated—a complex of concepts in which organic selection of ontogenetic
adaptations produces individual "adaptations," negative natural selection swats down whole organisms before reproduction, germinal selection plays a creative role producing heritable adaptations, and phylogeny is decidedly progressive—is wholly abandoned by the Modern Synthesis. Physiological and behavior adaptiveness, even when reinforced, is not an adaptation, but merely the instantiation of genetically underwritten inherited adaptations; natural selection affects reproductive rates of populations, and only indirectly relies on the life or death of individuals; the variant alleles that are the creative material of natural selection code for phenotypes at the organismic, not at the germinal, level (at least until the rise of gene-level selection); and, finally, evolution by natural selection is not inherently directional. These differences pose questions about the Baldwin effect could survive in any recognizable way in the new theoretical environment. My suggestion is: not very well.

The makers of the Modern Synthesis of the 1940s and '50s varied a good deal among themselves about the answer to this question. Huxley, as I have mentioned, was something of a Baldwin booster. "The principle of Baldwin and Lloyd Morgan," he wrote in Evolution: The Modern Synthesis, shows how Lamarckism may be simulated by the later replacement of adaptive modifications by adaptive mutations... In areas outside the normal habitat of the species... the extension of habitat may in the first instance be dependent on a non-inherited modification of behavior, mutation and selection later stepping in to fix the change genetically. (Huxley 1942: 1, 14)

For his part—and it was a considerable part indeed—Simpson was not entirely negative. For him, the effect meant that "characters individually acquired by members of a group of organisms may eventually, under the influence of selection, be re-enforced or replaced by similar hereditary characters" (Simpson 1953: 110). So understood, Simpson thought that the Baldwin effect is "fully plausible under current theories of evolution" (Simpson 1953: 115). It can happen, however, only where several contingently related circumstances coincide. First, since adaptations are by definition based on gene frequencies, an adaptive novelty can occur in individuals within a population only if a gene or gene complex codes for a trait that has a fairly wide "norm of reaction" at the phenotypic level. In this analysis, Simpson was following the lead of the Russian Darwinian J. I. Schmalhausen, who, in struggling to defend Darwinism against state-sponsored Lysenkoism as intently as Baldwin and other Darwinian psychologists had once struggled against Social Darwinism and neo-Lamarckism, rested his case for a Darwinian mimicry of the inheritance of acquired characteristics on the notion that genes typically have a range of phenotypic effects, and that what looks like the heritability of acquired characteristics is merely a shifted norm of reaction of genes that are already there (Simpson 1953: 115–116; Schmalhausen 1949). Second, a behavior or habit preserved across generations by cultural transmission can causally lead to changes in gene frequencies only if "there occur in the population genetic factors producing hereditary characteristics similar to the individual modifications... or having the same sorts of adaptive advantages" (Simpson 1953: 112). This is roughly Baldwin's and Lloyd Morgan's idea of a concurrence between germinal and socially inherited factors. But—and this is the crucial point—it is Baldwin's and Lloyd Morgan's idea shorn of any theoretical reasons why in the long run such a concurrence must form the leading edge of evolutionary change.

Indeed, given the theoretical framework of the Modern Synthesis there are good reasons to think that such a concurrence will seldom, if ever, occur at all. If learned behaviors are so effective in getting a useful trait passed from generation to generation at the cultural level, there will presumably be no selection pressure for the spread of genetic factors favoring that trait. Simpson claimed that in circumstances where flexible responses are required to meet the challenges of changing environments learning can be presumed to be more effective than hard-wired responses. To show this, he deployed against Baldwin the same argument that Baldwin had used against the Lamarckians. If learned behaviors do become genetically underwritten, a population will be swapping "short term and more plastic [learned behaviors] for long term, but more rigid adaptations," thus subverting the very point of the Baldwin effect (Simpson 1953: 116). On an even more skeptical note, Simpson added that it would be very difficult to tell for sure if it had happened, since the theoretical presumption must always be that existing adapted gene complexes with wide norms of reaction are merely surfacing under new selection pressures rather than that learning is antecedently causing or guiding a shift in gene frequencies. Given the variety of nature, as well as an analogy between the Baldwin effect and C. H. Waddington's "genetic assimilation" to which I will turn momentarily, Simpson was loathe to deny that the phenomenon might have occurred
change both precedes and causes adaptations. Serves the insistence of the makers of the Modern Synthesis that genetic scrambled one, precedes the expression of an adapted phenotype and so pre­

work of the Modern Synthesis. Even here, a genetic basis, albeit a newly

for comparing the Baldwin effect to genetic assimilation within the frame­

netic assimilation are not necessarily adapted, this scenario forms the basis

Leaving aside the troublingly disanalogous fact that phenotypes under ge­

conditions where loss of genetic and phenotypic flexibility is a small cost to

pay under dire circumstances for basic survival. Any port will do in a storlll.

ably appear” (Simpson 1953: 11 Presumably, this will take place

sue when selection for the a bility

narrows the developmental range that the character would usually or invari­

ducible in later generations, even those not subjected to the initiating shock. In Waddington’s view, as well as that of other respectable Darwin­

ians of the Modern Synthesis, this happens because the shock “destabilizes

a developmental system and reveals genetic variation that was previously concealed” at a much deeper level than, say, alternative alleles for darker and lighter pepper moths (Waddington 1962: 226–227). Presumably, this

is what is happening in cases that one might be tempted to chalk up to the

Baldwin effect. In contrast to the genetic-variation-preserving thrust of adaptation at the genetic level and the presumed plasticity at the phenotypic level that a flexible genetic inheritance favors, the Baldwin effect, as redescribed by Simpson, applies at best to unusual cases in which a pop­

ulation under very strong selection pressure (at the margins of its range, for example, as Huxley suggests) genetically “assimilates” a culturally transmitted phenotype by narrowing the genetic norm of reaction to a van­

ishing point. So described, Simpson wrote, “The Baldwin effect would en­

sure when selection for the ability to acquire an adaptive character so narrows the developmental range that the character would usually or invariably appear” (Simpson 1953: 116). Presumably, this will take place under conditions where loss of genetic and phenotypic flexibility is a small cost to pay under dire circumstances for basic survival. Any port will do in a storm. Leaving aside the troublingly disanalogous fact that phenotypes under genetic assimilation are not necessarily adapted, this scenario forms the basis for comparing the Baldwin effect to genetic assimilation within the framework of the Modern Synthesis. Even here, a genetic basis, albeit a newly scrambled one, precedes the expression of an adapted phenotype and so preserves the insistence of the makers of the Modern Synthesis that genetic change both precedes and causes adaptations.

at some time or another (Simpson 1953: 115). Still, he concluded that there is “singularly little concrete ground for the view that [the Baldwin effect] is a frequent and important element in adaptation” (Simpson 1953: 115).

Simpson’s interest in the Baldwin effect was stimulated by Conrad H. Waddington’s mention of it in connection with “genetic assimilation,” which was the subject of an article by Waddington in the same issue of Evolution as Simpson’s 1953 article (Waddington 1953). Waddington had reliably and replicably shown that strong shocks to fruit flies will produce phenotypes that subsequently, and often quite rapidly, become genetically heritable in later generations, even those not subjected to the initiating shock. In Waddington’s view, as well as that of other respectable Darwin­

ians of the Modern Synthesis, this happens because the shock “destabilizes

a developmental system and reveals genetic variation that was previously concealed” at a much deeper level than, say, alternative alleles for darker and lighter pepper moths (Waddington 1962: 226–227). Presumably, this

is what is happening in cases that one might be tempted to chalk up to the

Baldwin effect. In contrast to the genetic-variation-preserving thrust of adaptation at the genetic level and the presumed plasticity at the phenotypic level that a flexible genetic inheritance favors, the Baldwin effect, as redescribed by Simpson, applies at best to unusual cases in which a pop­

ulation under very strong selection pressure (at the margins of its range, for example, as Huxley suggests) genetically “assimilates” a culturally transmitted phenotype by narrowing the genetic norm of reaction to a van­

ishing point. So described, Simpson wrote, “The Baldwin effect would en­

sure when selection for the ability to acquire an adaptive character so narrows the developmental range that the character would usually or invariably appear” (Simpson 1953: 116). Presumably, this will take place under conditions where loss of genetic and phenotypic flexibility is a small cost to pay under dire circumstances for basic survival. Any port will do in a storm. Leaving aside the troublingly disanalogous fact that phenotypes under genetic assimilation are not necessarily adapted, this scenario forms the basis for comparing the Baldwin effect to genetic assimilation within the framework of the Modern Synthesis. Even here, a genetic basis, albeit a newly scrambled one, precedes the expression of an adapted phenotype and so preserves the insistence of the makers of the Modern Synthesis that genetic change both precedes and causes adaptations.

This view of the conditions under which something that might be called the Baldwin effect could conceivably occur was, I want to suggest, influential in the subsequent dismissal of the putative phenomenon altogether. This negative reading is registered most clearly in Ernst Mayr’s 1963 Animal Species and Evolution. In reviewing Simpson’s version of the argument, Mayr pronounced the very idea of the Baldwin effect incoherent. For Mayr, the Baldwin effect falls between two stools. Baldwin’s original version, he asserts, “has no validity” at all. In assuming that “organic selection” is an alternative to natural selection, Baldwin implies not a reconciliation of Darwinism and Lamarckism, but a disguised or cryptic form of Lamarckism in which phenotypic innovation is said actually to cause new genotypes rather than to favor a new arrangement or uncon­

cealment of already existing genetic variation (Mayr 1963: 610). This was a pointed remark in light of the recent Lysenko affair. But even under Simp­

son’s redescription, Mayr could not imagine any circumstances in which there would be an adaptive advantage to genetically fixing a previously flexible phenotype in a way that is comparable to genetic assimilation. As a universal rule, Mayr writes, “Those genes will be selected . . . which produce genotypes with an optimal modifiability of the phenotype” (Mayr 1963: 612). There is no reason to think that adaptive natural selection could play a role, then, in collapsing norms of reaction, even in cases where stress is involved. Indeed, it is just such cases that led Mayr to assert that his pet theory of allopatric speciation by means of wholesale genetic reorganiza­

ation at the periphery of an isolated population is actually paradigmatic of adaptive natural selection at work.

Dobzhansky seems to have agreed (Dobzhansky 1970: 211). The premium placed by his theory of “balancing selection” on retaining vast amounts of genetic variation in natural populations was designed to high­

light the presumption that adaptive natural selection favors plastic phenotypes, phenotypes with very wide norms of reaction. Both Mayr and Dobzhansky thought that selection, in favoring the evolution of phenotypic plasticity, also favors the development of cultural transmission. As the philosopher Robert Brandon puts the point, “One would expect a species subjected to [changing] conditions to become highly plastic and to develop culture” (Brandon 1996: 82). For the makers of the Modern Syn­

thesis, culture is natural selection’s greatest achievement. But the very
reasons for thinking this also imply that there is no path back from culture to a world in which behavior is governed directly by natural selection. It was this strongly autonomous view of culture that in my view turned the modest retreat proposed by E. O. Wilson's "sociobiology" into a full-scale crisis in evolutionary biology in the 1970s.

To describe the Baldwin effect in ways that made it analogous to, or even a "special kind of," genetic assimilation was, then, bad news for the Baldwin effect. Simpson's choice of the term "effect," whether intentionally or not, could not have been better calculated to expose the general idea that learning guides evolution to obloquy. The term "effect" is associated with a theory-neutral phenomena that is waiting to be explained by this or that theory. Genetic assimilation is an effect in this sense. But the Baldwin effect is not. No straightforward, theoretically neutral case of the Baldwin effect has ever been reported or agreed on. Rather, the Baldwin effect is a hypothesis that might be used to explain this or that phenomenon, such as the mix of learning and instinct in bird song, foot calluses, or lactose tolerance.

Even then, however, Baldwinian explanations are no better than the theoretical background that licenses them. They were favored by the version of Darwinism assumed by Weismann, Baldwin, and Lloyd Morgan. They were at a considerable disadvantage, however, in a conceptual environment dominated by Simpson, Dobzhansky, Mayr.

This disadvantage can be seen clearly in the fact that, much to Waddington's annoyance, repeated comparisons of the Baldwin effect to genetic assimilation in the 1950s and 1960s were soon casting a shadow over the genetic assimilation itself. While no one doubted that it happened sometimes, it was generally treated as at most a peripheral, and not very important, mechanism of possible evolutionary change. Dobzhansky was even more dismissive. He called it a "tour de force," but one "achieved by manipulation of the external rather than the genetic environment" (Dobzhansky 1970: 211). Dismissing genetic assimilation in this way also meant driving a stake through the heart of the Baldwin effect. Comparison between genetic assimilation and "alleged Lamarckian inheritance is superficial," Dobzhansky proclaimed (Dobzhansky 1970: 211). This reading became the dominant one because the makers of the Modern Synthesis, having marginalized developmental biology from the outset, could not see why Waddington had fancied the comparison between the Baldwin effect and genetic assimilation in the first place. In large part, that is because ontogenetic processes were off their screen; what Dobzhansky and Mayr saw was only natural selection operating on adult phenotypes in populations. It was quite otherwise for Waddington. While he admitted that genetic assimilation is the manifestation of preexisting genetic variation, Waddington's point was that whether and when variation is triggered depends on the crucial role of formed and forming tissues in "transferring competence" during the embryological process. Because Dobzhansky, Mayr, and Simpson considered the values of only two variables, genotypes and phenotypes, rather than attending to the role of embryology, which Waddington took to be the most proximate causal factor, they were inclined, according to Scott Gilbert, to put Waddington on the side of the Lamarckians and so to call his Darwinian credentials into question (Gilbert 1991: 205, n. 53).

4 Two Contemporary Baldwin Boosters

In view of the growing hostility of Simpson, Mayr, and Dobzhansky that I have recounted, it is odd that the Baldwin effect, or evolutionary scenarios that choose to go by that name, should have come into vogue again. For his part, Deacon acknowledges the tension; he speaks of either "Darwinian or Baldwinian" explanations (Deacon 1997: 328). Dennett, on the other hand, claims that the Baldwin effect is "a no longer controversial wrinkle in orthodox Darwinism" (Dennett, chap. 4, this volume). This conflict requires some explanation, especially in view of the fact that it is Deacon, I will suggest, whose version of the Baldwin effect is closer to the spirit of the mid-century Modern Synthesis than Dennett's. Dennett's approach reflects the influence of post-Synthesis versions of Darwinism in which game-theory and genetic algorithms are deployed in conjunction with selfish genes to trace the evolution of optimally adapted functional modules, including, perhaps, a "module" for language.

In The Symbolic Species, Deacon invokes the Baldwin effect in the course of trying to explain the same things that Dennett wants to explain: the rapid evolution of brain, language, and representationally mediated intentional activity. The details of his case are not relevant in the present context, except to note that Deacon thinks that the acquisition of even a minimal capacity for using symbols creates a niche in which very strong selection
pressures were brought to bear against members of human populations who failed to acquire this capacity. Rather than being a mere side effect of an enlarged brain, protolinguistic capacities may well have helped (in a co-evolutionary way) cause the brain’s expansion, as well as other species-specific adaptations, such as changes in the position of the larynx that permit enhanced vocalization.

In developing this argument, Deacon prepares the way by putting a Baldwinian spin on two well-known stories: lactose tolerance among herding populations, and selection in favor of heterozygotes that confer some protection against malaria. Deacon is aware that orthodox neo-Darwinian stories are available for both phenomena. In human populations that follow herds, alleles that allow infants to digest milk are not shut down immediately after weaning, as is normally the case, but instead remain operative at increasingly deferred points in the life cycle. The Modern Synthesis can easily interpret this by saying that members of the relevant subpopulations deferred shutting down genes for breaking down lactose before they became radically dependent on milk products, not (or at least dominantly) the other way around. The case of sickle-cell anemia and resistance to malaria has an even more canonical explanation. It is a virtual paradigm of Dobzhansky’s theory of balancing selection, not of the Baldwin effect. The benefit conferred by having an allele that sickles blood cells, thereby conferring some degree of resistance to malaria, far outweighs the resulting illness in circumstances where the alternative is death, and so spreads rapidly through the population. (The cost-benefit ratio changes, of course, when these populations migrate to, or in this case were transported to, malaria-free environments.) Nonetheless, Deacon puts a decidedly Baldwinian accent on these cases by stressing the initiating and sustaining, and hence causally primary, role of cooperating human agents in creating and maintaining the environmental conditions down which cascades of gene frequency changes by means of natural selection can, and, in his opinion, must have proceeded to support the new dependence on an environment shaped by human activity. This is what Deacon calls “niche construction.” “Whether Darwinian or Baldwinian,” he writes, “the evolution of genetically based adaptations is a function of the long-term invariance of conditions that affect reproductive success” (Deacon 1997: 328). Accordingly, Deacon writes that

It is no coincidence that the human populations with the highest percentage of lactose-tolerant adults are those where animals have been herded for the longest time, and those with the least lactose tolerance are those where herding was introduced most recently or not at all. (Deacon 1997: 323)

and that the sickle cell trait spread quite rapidly in Africa in recent prehistory because of human activity. . . . Probably the critical historical event that catapulted malaria to an epidemic disease was the introduction of agriculture and animal husbandry into Africa between five and ten thousand years ago. This culturally transmitted practice modified the tropical environment to create the perfect breeding ground for mosquitoes. . . . The human population was thrust into a context in which powerful selection favored reproduction of any mutation that conferred some resistance to malaria. (Deacon 1997: 323)

Deacon calls these cases “Baldwinian rather than Darwinian” in part because he explicitly dissects from the insistence of the lions of the mid-century Synthesis that adaptive natural selection always favors phenotypic flexibility (Deacon 1997: 323). About that they were just wrong. In some cases, he argues, it makes sense to lose phenotypic flexibility in order to ensure environmental stability and adaptedness to that stable environment. Soon enough the disadvantage conferred on members of a population that cannot more or less effortlessly acquire the behavior in question will be felt. An environment in which maintaining a learned behavior has become a matter of life and death survival for the population in question (shades of fly-swatter selection) will thus incur “costs in terms of learning times, costs for failing to learn, or learning incorrectly, and costs for simply being inefficient” (Deacon 1997: 326). In these conditions, Deacon argues, “any predisposition that even remotely contributes to producing a more reliable and efficient response will be positively selected” (Deacon 1997: 326). Deacon sees this dynamic at work in the progressive autonomization of language acquisition abilities.

In recent work, Deacon has had new thoughts, some of which he shares in the present volume (Deacon, chap. 5, this volume). His stress on the agency of organisms, especially of organisms that possess culture, in constructing environments that in turn exert their own selection pressures remains a central theme in his work. But Deacon has become increasingly insistent that the learned traits in question—herding in the case of lactose-tolerance, slash-and-burn agriculture in the case of sickle-cell anemia, and language-acquisition coincident upon an enlarged brain—are not
genetically assimilated. They require learning, and plenty of it. Nonetheless, to the extent that the new behavior becomes absolutely necessary for survival and reproduction in a cultural niche, gene frequencies do change radically in favor of all manner of supportive adaptations that render the learned behavior more easily and universally acquired. There are no genes for herding cows, or for planting crops—or, indeed, for a "language instinct," at least of the sort postulated by Steven Pinker (Deacon 1997: 328). Nonetheless, as populations become dependent on herding, even at the cost of some digestive distress, regulatory genes that defer the shutting down of lactose-digesting metabolic pathways spread quickly and thoroughly through the population. So do genes that confer protection against malaria. An even more telling case is the dependence of modern humans on agriculture to supply ascorbic acid. Although ascorbic acid is obligatory, selection pressures that would unmask buried metabolic pathways that supply this vital nutrient metabolically are screened off by the construction and maintenance of cultural practices that ensure it by other means. So too with the traits that support language acquisition.

Since writing The Symbolic Species, Deacon has resisted thinking of his account of language-acquisition as straightforwardly Baldwinian. The Baldwin effect refers, in his view, to the unmasking of previously hidden genetic variation under conditions in which strong selection pressures, and collapsed norms of reaction, are in play (Deacon, chap. 5, this volume). That is essentially Simpson's mid-century interpretation, to which Deacon cleaves. By this standard, language acquisition, which on Deacon's view deflects natural selection from fixing a trait genetically by favoring supportive adaptations, is a kind of Baldwinism in reverse. Nothing is in the genome that doesn't have to be. But what there supports an obligatory dependence on learning by way of supportive genetic adaptations that often go to fixation. Accordingly, language acquisition is even further from genetic assimilation, which the makers of the Modern Synthesis conflated with the Baldwin effect simply because from the perspective of their conceptual scheme both seemed to have in common a certain "pseudo-Lamarckism" (Deacon, chap. 5, this volume). Having teased these concepts apart, however, we might profitably recall from our earlier discussion that Simpson's and Mayr's reconstruction of the Baldwin effect involved recasting it in something other than its original conceptual framework. This being so, Deacon's "reverse Baldwinism" might actually be closer, ceteris paribus, to Baldwin's and Lloyd Morgan's original concept of the relation between organic selection and evolutionary change than it would seem from a mid-century perspective. Baldwin and Lloyd Morgan too required strong selection pressures, sometimes at the cost of death; a collapse of norms of reaction; a conception of organisms as agents that are able to construct and maintain their own environments; and the (anti-Spencerian) notion that germ-line modifications support and reinforce, rather than actually replace, phenotypic plasticity.

These reflections reveal a certain continuity between Deacon and the Modern Synthesis. This impression is reinforced by noting that Dobzhansky's heir, Richard Lewontin, has also stressed the causal primary of niche construction, not only in the human case, but in the case of most organisms (Lewontin 1983; 1992: 32)—although, unlike Deacon, Lewontin will not retreat an inch from the view that natural selection has produced in humans full cultural autonomy and phenotypic plasticity, as his implacable hostility to sociobiology, evolutionary psychology, and to what he regards as the fatuous promises of the Human Genome Project shows (Lewontin 1992). In the matter of evolving genetic adaptations that help make certain kinds of learning obligate, moreover, Deacon appeals to the vastly enlarged supply of genetic variation that gene-reduplication and exon-shuffling have made available. But the insistence on new sources of genetic variability that can be maintained in human populations has since the 1940s been the hallmark of Dobzhansky's version of Darwinism. Here too Deacon reveals his continuity with received theory. It is also possible, however, that Deacon's "reverse Baldwinism," which increasingly stresses the interaction between cultural and genetic evolution, might resonate with something like Developmental Systems theory, which does not countenance privileging genes as developmental resources, but instead treats niche construction by human activity, Waddington-style embryology, and genes as mutually reinforcing, and presumptively causally equal, developmental resources (Griffiths, chap. 10, this volume). These developments will appear non-Darwinian only if the term Darwinism is exclusively reserved for the optimization
thinking that has become increasingly well known in recent decades. (See Weber and Depew and 2001.)

In contrast to Deacon, who takes note of his differences with the Modern Synthesis because he shares a good deal of its conceptual background, Dennett tends to downplay the discontinuity between the orthodox Synthesis and his version of Darwinism, at least when it comes to the legitimacy of the Baldwin effect. In *Darwin's Dangerous Idea*, Dennett admits that the Baldwin effect has “typically been shunned by overcautious thinkers, because they thought it smacked of the Lamarckian heresy” (Dennett 1995: 78). We can guess that he means Simpson, Mayr, and Dobzhansky. After the work of Hinton, Nowlan, and Maynard Smith, however, Dennett argues that the Baldwin effect should be considered “no longer a controversial wrinkle in orthodox Darwinism” (Dennett, chap. 4, this volume). He appears to conclude that it was a merely contingent fact—lack of access to computational machines, programs, and models—rather than conceptual disagreement that led people like Simpson, Dobzhansky, and Mayr to fail to understand that the Baldwin effect can be part of the “orthodox” Synthesis itself. (In a similar way, Dennett argues that Darwin effect can be grasped fully the nature and consequences of what Dennett still takes to be his, namely Darwin’s, Dangerous Idea [Dennett 1995].)

It is no doubt true that Dennett would like to recruit the authority of Modern Synthesis for his version of genetic Darwinism. Nonetheless, the differences between his version and the Modern Synthesis are fairly large. Dennett turns to the Baldwin effect as a way of accounting for the rapid co-evolution of the physiological, mental, linguistic, and behavioral characteristics that mark off our quite young species from other hominids, and perhaps hominids from primates. Dennett has Baldwin, as reconstructed by Richards, holding that a “species will evolve faster because of its greater capacity to discover design improvements in the neighborhood” through a process of behavioral trial and error (Dennett 1995: 79). (“Design improvements” is Dennett’s concept, not Richards’s or Baldwin’s.) As Dennett makes clear in his contribution to this volume, however, it is not just evolutionary tempo that is in question, but the need to ensure that natural selection moves in a concerted direction as it explores fitness landscapes in what Dennett calls the “design space” that lead toward big brains, behavioral plasticity, and speech (Dennett, chap. 4). Dennett’s scenario for the

Baldwin effect relies on the lucky hard-wiring of the neural system of an individual (or perhaps small group of individuals) who happens to perform a “Good Trick,” which, if it were to spread in a population, would solve a significant, pressing adaptive problem. “With this Good Trick,” Dennett writes, “comes a minimal capacity to ‘recognize’ (in scare quotes) a tiny bit of progress, to ‘learn’ something by blind trial and error” (Dennett 1995: 78–79). The required spread through the population is assured by reinforcing the behavior in offspring and other members of the population. Dennett then relies on Hinton and Nowlan, as glossed by Maynard Smith, to show that such learned and relearned tricks will be favored by reiterated bouts of natural selection moving in the direction pointed by learning. The assumption must be that these selection pressures are very strong, that they move in a concerted direction, and that subsequent gene frequency changes both optimize and autonomize the behaviors in question.

Whether this scenario, or the mechanism on which it rests, is the same as that proposed by Deacon is a matter of dispute. The issue is explored in a subtle three-way exchange among Godfrey-Smith, Dennett, and Deacon in this volume (Godfrey-Smith, Dennett, and Deacon, chap. 6, this volume). On the descriptive surface, however, it is for Dennett a neurological, or perhaps even a genetic, variant rather than wide norms of reaction that is causally responsible for the initial behavior; and learning is seen as capable of marking off evolutionary vectors not because a shared environment brought into existence by the spread of the novel behavior exerts a new selection pressure on the population as a whole, but because competition among individual members of society for the reproductive benefits brought by the Good Trick is very stiff. This individualist picture accords well with Dennett’s own theoretical framework, according to which natural selection itself is a negative feedback process, an “algorithm” for generating and testing variations (Dennett 1995). It accords less well than Dennett might like to admit, however, with the way in which the Baldwin effect was reconstructed by Simpson and other mid-century figures.

Construing natural selection as an algorithm encourages the reader to think of natural selection itself, and not just the adaptations it brings forth, as operating in a concerted, end-oriented, optimizing way, and so justifies Dennett’s confidence that the results of genetic algorithms can be read directly into nature’s ways. So concerted is the effect of a Good Trick that,
according to Dennett, it confers on those who possess it a tiny bit of “look ahead” not only into what is immediately necessary for task at hand, but into the direction of evolution (at least in their lineage) itself. This claim, if interpreted in this way, may well echo Baldwin’s and Lloyd Morgan’s view that evolution marches in the direction marked off by organic adaptations, or, roughly, learned behaviors. If interpreted charitably, it might be a good account of adaptive dynamics. Nonetheless, the conceptual scheme that permits the first uncharitable interpretation is not, as we have seen, one that could be countenanced by the orthodox Modern Synthesis. While wide arrays of genetic variation in populations allow novel, potentially imitable behaviors to occur in populations of social animals, and in addition confer on populations the genetic plasticity that allows them to remain adapted to changing environments, this very stress on genetic variety and phenotypic plasticity—a conception that is at the core of the fully articulated Modern Synthesis—blocks any sort of “look ahead” that foreshadows, either at the phenotypic or genotypic levels, the direction of evolution itself (chap. 2, this volume). It was for just this reason that the Baldwin effect was placed under suspicion by the Modern Synthesis. It is also why Deacon, in his second thoughts, has retreated from thinking of the role of learning in evolution as straightforwardly Baldwinian. If the Baldwin effect, under this redescription, does not fall under suspicion in Dennett’s work, it is perhaps because his version of genetic Darwinism, while it might very well be superior, differs from that of the Modern Synthesis.

5  An Encouraging Conclusion

In this essay, I have argued for two theses. The first is that there is no theory-neutral empirical phenomenon that can be named “the Baldwin effect.” The second is that the term “Baldwin effect” cannot name even a theoretical concept that maintains fixity of reference between Baldwin’s version of Darwinism, Simpson’s version, and either Dennett’s or Deacon’s, which themselves diverge. The moral I wish to draw from these claims, however, is a cautionary, and perhaps even an encouraging, one. Just as there was considerable conceptual slippage between the so-called Baldwin effect in its first and second reconstructions, so too there might very well be slippage between the fate of Baldwinism in a new, post-Synthesis framework and how it appeared to Simpson and the other framers of the Modern Synthesis. The very fact that Deacon’s version of the Baldwinian idea calls into question what it takes to be arbitrary dogmas of Modern Synthesis—its prohibition on collapsed norms of reaction, for example, or its a priori insistence that gene frequency changes must always precede phenotypic heritability—reinforces the observation that the Modern Synthesis is being buffeted by many challenges, and may, taken as a totality, be a thing of the past. So too does Dennett’s refiguring of natural selection, in the age of computation, as a cybernetic process. Admittedly, there is some irony in the circumstance that, if I am right, Deacon’s version of the Baldwin effect remains closer to the central principles of orthodoxy than Dennett’s. For it is Dennett who professes himself to be drawing out implications of the tradition, while, in dissenting from subsidiary, but influential, hypotheses that were presumably insisted upon by the makers of the Modern Synthesis, Deacon downplays the degree of continuity between his theory and the fundamental principles of orthodoxy. The main lesson, however, is this. The fact that we may be entering into a post-Synthesis period need not be an objection to creative appropriations of the Baldwinian idea by Deacon, Dennett, or anyone else. If the history of Darwinism generally, and of the Baldwin effect specifically, is any guide, we should be wary of dismissing hypotheses just because they do not fit with received interpretive schemes. For it is possible that new appropriations of the general Baldwinian idea may go hand in hand with the emergence, if sometimes obscurely and in statu nascendi, of theoretical frameworks that may in the end prove more empirically satisfactory than their predecessors.  

Notes

1. It would be possible to argue that Baldwin discovered the principle of operant conditioning. Since Baldwin habitually claimed priority for new ideas in biological psychology, he would have been gratified by this attribution. This is a point made by Paul Griffiths (chap. 10, this volume).

2. Weismann’s argument first became known in the English-speaking world in 1889 with a translation of his Essays upon Heredity and Kindred Biological Problems (Weismann 1893). They became far more widely known to the reading public, however, and charged with political meaning, only with the appearance in 1893 of an article in Contemporary Review entitled “The All-sufficiency of Natural Selection: A Reply to Herbert Spencer” (Weismann 1893).
3. James, who had been attracted to it in his youth, rejected Spencerism, and de­spised Social Darwinism. In an 1878 letter to his boss, Harvard president Charles Norton Eliot, he had written, "My quarrel with Spencer is not that he makes much of the environment, but that he makes nothing of the glaring and patent fact of sub­jective interests which cooperate with the environment in molding intelligence" (James to Eliot, November 22, 1878; quoted in Richards 1987: 426-427). James's fidelity to Darwinism is evident in the support he gives Weismann in the final pages of the second edition of his Principles of Psychology (James 1890: 678-680). In the same place, however, James reiterated his belief that it would be helpful "if habits could bear fruit outside individual life, and if the modification so painfully acquired by parents' nervous systems could be found ready made at birth in those of the young" (James 1890: 680-681). Alas, James was unclear how this might happen under the exclusive regime of hard inheritance—the very point on which Baldwin and Lloyd Morgan profess to give an answer. Thus James could do little more com­fort himself in the final sentence of his revised masterpiece with the thought that "the actual course of psychogenesis" may be forever occluded as "the slowly gathering twilight closes into utter night" (James 1890: 689).

Dewey's early Darwinism shows signs of having profited from Baldwin's 1895 book, from the press battle in Science and the American Naturalist that followed in 1896, and perhaps from Lloyd Morgan's lecture tour, which brought him to Illi­nois. Dewey's earliest recorded thoughts about natural selection stress Baldwin's notion that behavior is shaped by a process of organic selection. He alludes in a re­view written in 1896 to those having competent knowledge of details have good reason [for claiming that] not only is one form of life as a whole selected at the expense of other forms [for a population], but one mode of action in the same individual is constantly selected by the success or failure of special acts—the counterpart, I suppose, of physiological selection so called. We do not need to go here into the vexed question of the inheritance of acquired characters. We know that through what we call temporary genetic Darwinism, especially through the work of Dobzhansky (Dobzhansky 1970) and Lewontin (Lewontin 1974). Along the way, however, the term seems to have become ever more restricted to norms of reaction that are not so random and capricious that they could never become his­torical, or adaptive, responses. This has become a fundamental principle of con­temporary genetic Darwinism, especially through the work of Dobzhansky (Dobzhansky 1970) and Lewontin (Lewontin 1974). Along the way, however, the term seems to have become ever more restricted to norms of reaction that are adapta­tions. Schmalhausen's openness on this point may well have influenced Waddington's and even Simpson's comparison of the Baldwin effect with genetic assimilation. For genetic assimilation is sometimes indeed nonadaptive. I owe this point to Allan Love.

4. I am not entirely sure how to reconcile this conception of natural selection with Lloyd Morgan's earlier proposal, cited by Richards (1987): 390, to distinguish between natural selection and "natural elimination," and to identify something close to Baldwin's ontogenetic adaptation as natural selection—the same proposal made by Dewey, except that it seems to be a general claim rather than a special claim about humans.

5. Schmalhausen recognizes that "development is determined not only by the genotype but by environment factors. Therefore, the genotypic expression of both normal organisms and mutants is different in diverse environments" (Schmalhausen 1949: 4). Schmalhausen's term "norms of reaction" names the width of such re­sponses. Schmalhausen does not, however, think that all norms of reaction are either adaptive or adaptations. They include "adaptive modifications of the organism to different environments" (7), but also include "nonadaptive modifications . . . which have not yet attained an historical basis." Indeed, Schmalhausen claims that "all really new reactions are never adaptive" (8). These are, he says, "very unsta­ble," in contrast to "adaptive modifications," which are stable precisely because they have fairly wide norms of reactions, and thus can adjust to all environmental changes that are not so random and capricious that they could never become his­torical, or adaptive, responses. This has become a fundamental principle of con­temporary genetic Darwinism, especially through the work of Dobzhansky (Dobzhansky 1970) and Lewontin (Lewontin 1974). Along the way, however, the ter­m seems to have become ever more restricted to norms of reaction that are adapta­tions. Schmalhausen's openness on this point may well have influenced Waddington's and even Simpson's comparison of the Baldwin effect with genetic assimilation. For genetic assimilation is sometimes indeed nonadaptive. I owe this point to Allan Love.

6. I am grateful to audiences at Bennington College, the Center for Philosophy of Science, University of Pittsburgh, and the University of Iowa for many good sug­gestions. An earlier, much different version of the argument in this paper appeared in Artificial Life 29 (1996), 7-20. I am grateful to Soren Brier for comments on that version. I am also grateful to Terry Deacon for helpful comments on the present version.

References


