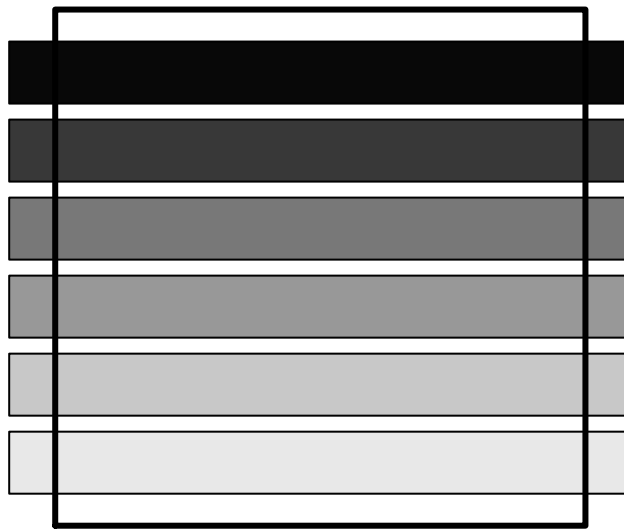


# LES CAHIERS DU LANCI



*CULTURAL EVOLUTION, THE BALDWIN EFFECT,  
AND SOCIAL NORMS*

**Jean Lachapelle, Luc Faucher et Pierre Poirier**

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# ***CULTURAL EVOLUTION, THE BALDWIN EFFECT, AND SOCIAL NORMS***

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The goal of this paper is to analyze the role of the Baldwin effect in cultural evolution and to propose that it played a fundamental role in the evolution of social norms. Drawing on a recent interpretation of the Baldwin effect proposed by Godfrey-Smith (2003), it is argued that the Baldwin effect should be construed in terms of *niche construction*. The paper appeals to the works of Deacon (1997; 2003) to illustrate the process of niche construction, and then concludes by applying a Baldwinian process of niche construction to the case of social norms.

Keywords: Baldwin effect, cultural evolution, social norms, niche construction.

## **1. Introduction: Outline and purpose of the paper**

Over the last twenty years, it is fair to say that the Baldwin effect has made a comeback. Indeed, after having been neglected for a long time in the 20th century, more and more evolutionary theorists now seem inclined to go back to Baldwin and the factor he claimed to have discovered in 1896. This trend is evident in a recent book edited by Weber and Depew (2003) entirely devoted to reconsidering the Baldwin effect. The expression the *Baldwin effect* was coined by George Gaylor Simpson in 1953, who, interestingly, was mainly responsible for the bad reputation of the Baldwin effect. Simpson's final assessment of the Baldwin effect was that, while such an effect was theoretically possible, it was most likely a rare instance in nature. For this reason, little attention should be paid to it. Which is exactly what happened for a long period of time in the 20th century; that is, until a renewal of interest for the Baldwin effect could be observed in the works of people who share different theoretical perspectives, such as Dennett (1991; 1995), Pinker (1994), and Deacon (1997). This new interest in the Baldwin effect was in

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part sparked by a computer simulation of the Baldwin effect by Hinton and Nowlan (1987), one that was welcome by John Maynard Smith who saw it as a first step towards demonstrating the theoretical soundness of the Baldwin effect. Hinton and Nowlan showed that the Baldwin effect is possible within a strictly Darwinian framework. To do so, they used a genetic algorithm and an extreme simplification of phenotypic plasticity and the genotype. The genotype, which specified the structure of a neural network, was a string of three types of symbols (1, 0, and ?). The first symbol (1) specified the presence of a connection, the second (0) its absence, and the third (?) was a switch which could be opened (1) or closed (0) during the phenotype's lifetime (hence a kind of phenotypic plasticity). Only one genotype had higher fitness than the others, and all of the latter had equal fitness (this is what's called a needle-in-a-haystack function). The simulations showed that evolution unaided by plasticity is very slow (since it literally had to find a needle in a haystack). But allowing phenotypic plasticity made search in genetic space faster. Modification of the plastic phenotypes consisted in randomly drawing a value for each switch present in the genotype, until either the solution was found or the organism died. The genotypes that were initially close to the optimal genotype thus had a chance to be preferentially selected for reproduction (with mutations) and came to dominate the population. Once the whole population was closer to the optimal genotype (i.e., close to the needle), those genotypes that, by chance (mutation), had their switch (the ? symbol) replaced by the appropriate value, 0 or 1, according to the optimal genotype, were then preferentially selected over the others since they were then more likely than them to reach the solution before dying. Thus, one finds a simulation of the phenomenon described by Baldwin: plastic phenotypes that are first favoured by selection but then replaced by fitter non-plastic genotypes; hence, phenotypic plasticity followed by genetic assimilation. It should be noted that the last switches take a very long time to be replaced since little selective pressure is exerted on them (they are almost sure to find the solution by trial and error before the die).<sup>1</sup>

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<sup>1</sup> We thank Jean-Frédéric De Pasquale for his contribution here.

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In this paper we will first start with some introductory remarks on the Baldwin effect, our goal being to put the issue into perspective. Then a distinction between two versions of the Baldwin effect will be proposed, which will be referred to as the *narrow* version and the *extended* version of the Baldwin effect. Our claim will be that the extended version of the Baldwin effect is to be preferred to the narrow version. We will then appeal to the works of Deacon (1997; 2003) on the evolution of language to illustrate what the extended version of the Baldwin effect entails. Finally, we will make use of this extended version of the Baldwin effect to argue that it played a fundamental role in the evolution of social norms.

Our endeavor is congruent with one of the two main branches of evolutionary epistemology proposed by Bradie (1986; 1994), namely the distinction between the evolution of epistemological mechanisms programme (EEM) and the evolution of epistemological theories programme (EET; see the introduction by Gontier in this volume). While the latter seeks to construe the evolution of ideas and theories by analogy with evolutionary models, the former attempts to identify the evolution of mechanisms (e.g., the brain) that are responsible for the production of knowledge and cognition broadly conceived. What we attempt to do in this paper comes within the framework of the EEM. Specifically, we contend that the Baldwin effect, properly understood, is a mechanism whose role in the evolution of some social behaviors (Godfrey-Smith 2003: 65) has been underestimated.

## **2. What is the Baldwin Effect?**

All of this raises some important questions. What is the Baldwin effect? What is this effect supposed to do? What is its explanatory role in the theory of evolution? Is there any empirical support for it?

Two remarks are in order before we even attempt to answer these questions. First, as Depew (2003: 6) rightly points out in a recent paper, the Baldwin effect is neither a theory-neutral empirical phenomenon, nor a mechanism clearly identifiable by all evolutionary theorists. Rather, it is a hypothesis whose acceptance depends to a great extent on one's theoretical background, for instance one's approach to evolutionary theory. Second, our aim here is *not* to carry out a thorough exegesis of Baldwin's works. Even if we aimed to do this, it is doubtful whether we would ever pinpoint with precision what Baldwin had in mind with his *new factor in*

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*evolution*, because Baldwin himself changed his views from one paper to the other (Griffiths 2003). Rather, our goal is to find what's of theoretical interest in the Baldwin effect in light of recent developments in evolutionary theory. Thus, the interpretation of the Baldwin effect we propose below (see section 3) is informed by our commitment to a certain version of evolutionary theory. More specifically, our view of the Baldwin effect is influenced by the works of Boyd and Richerson (1985; 1992; 2002) on the evolution of culture, as well as by recent works in evolutionary theory that go under the name of Developmental Systems Theory (DST for short; see most contributions in Oyama, Griffiths, and Gray 2001).

In its most general sense, the basic idea underlying the Baldwin effect is that learning can, under certain conditions, affect the direction and rate of evolution by natural selection (Depew 2003: 3). At times, when they felt particularly confident (and temerarious), Baldwin and Conwy Lloyd Morgan went so far as to claim that learning is *the* leading mechanism driving evolution, which they opposed to natural selection. Such a stance might partly explain why most of the key players of the Modern Synthesis (e.g., Mayr) had little sympathy for Baldwin. However, as exaggerated as this claim may be, it must be understood in its proper historical context. Indeed, it was put forth at a time when Weismann had just given the final blow to Lamarckism, and some theorists like Baldwin and Conwy Lloyd Morgan felt that an evolutionary theory without some Lamarckian insights would be incomplete. Hence, they stressed the importance of learning in the evolutionary process.

Yet to claim that learning can affect evolution is so general that it only begs the question, not to mention that it can be seen as trivial. Which is why the Baldwin effect is typically broken down into two components, namely: (1) learning and phenotypic plasticity; and (2) the genetic assimilation of the trait learned. This second component was included in the Baldwin effect thanks to an interpretation proposed by Waddington in 1953 after having conducted experiments with fruit flies, in which he showed that some aspects of their phenotypes can become part of their genotypes in later generations. Here is how these two elements work according to this general description of the Baldwin effect from Godfrey-Smith (2003: 54):

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Suppose a population encounters a new environmental condition, in which its old behavioral strategies are inappropriate. If some members of the population are plastic with respect to their behavioral program, and can acquire in the course of their lifetime new behavioral skills that fit their new surroundings, these plastic individuals will survive and reproduce at the expense of less flexible individuals. The population will then have the chance to reproduce mutations that cause organisms to exhibit the new optimal behavioral profile without the need for learning. Selection will favor these mutants, and in time the behaviors which once had to be learned will be innate.

It is worth highlighting the main elements of the Baldwin effect in this description. The first point is that a particular environmental condition must prevail in order for the Baldwin effect to be triggered. We will argue below that such a condition — in which some evolutionary problems arise that call for a solution in terms of engineering<sup>2</sup> — is crucial. Note also the role of learning and plasticity here. The individuals with the ability to learn and modify their behavior given this new environmental condition have an edge over those lacking this ability and plasticity. And because of this edge, they are more adapted to their environment and this is likely to increase their fitness. In the long run, mutations favoring this learned trait are selected by natural selection. As a result, the trait becomes encoded in the genome and the individuals with this innate trait avoid the cost of learning it, which is the main evolutionary payoff of the Baldwin effect on this account.

Let us mention very briefly two examples of phenomena that are often cited in the literature as supporting the Baldwin effect. First consider the case of lactose tolerance. A long time ago, adults could not digest milk because of the lactose contained in it, which requires the production of a specific enzyme in sufficient number. This changed completely in populations of herders of milk-producing animals. As time went by, the specific alleles responsible for the production of this enzyme did not get shot down after weaning anymore, thus leading to lactose tolerance. Second, consider the case of (partial) resistance to malaria. Populations that began practicing agriculture and cutting down trees became increasingly exposed to malaria thanks to a greater presence of mosquitoes. As time went by, a specific gene coding for resistance to malaria evolved and protected *some* individuals against this disease; indeed, when produced in two copies this specific gene triggers a specific form of anemia.

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<sup>2</sup> In what follows, whenever we are referring to an organism's ability to *engineer* its environment, we are not assuming that such an organism has intentions with specific goals in mind (though this might be possible in the case of certain species). By engineering, we simply mean an organism's ability to modify or construct its environment in a way that is likely to be conducive to its fitness. So, for instance, an earthworm changing the structure and chemistry of the soil in which it lives engineers its environment in the way just defined (Odling-Smee, Laland, and Feldman 2003: 11).

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These two examples are cited by Deacon in *The symbolic species* (1997) as good candidates for the Baldwin effect. Interestingly, in a recent paper Deacon (2003) has changed his perspective and his remarks will prove to be useful for what follows. Indeed, Deacon remarks that *if* the Baldwin effect is *narrowly* conceived as implying a process going from a learned trait to the genetic assimilation of this trait, it is far from clear that these two examples provide any support for such a process. On the one hand, there does not seem to be a great deal of learning underlying the change in behavior in either of these two cases. On the other hand, genetic assimilation does not seem to take place — no phenotypic trait becomes part of the genotype. “*Nothing is made more innate,*” as Deacon (2003: 92) puts it.

### 3. Two versions of the Baldwin Effect

So, what does this tell us about the Baldwin effect? This certainly seems to provide support for the idea that there exists no theory-neutral phenomenon of the Baldwin effect. In fact, for theorists suspicious of the Baldwin effect, the two examples just discussed reinforce their conviction that it can be neglected and that the phenomena it purports to explain can be accounted for using a standard version of evolutionary theory.

We believe that such a conclusion is premature and rests on a conception of the Baldwin effect that is too stringent.<sup>3</sup> Therefore, we would like to make a distinction between two different versions of the Baldwin effect:

The *narrow* version of the Baldwin effect (what could be called the Baldwin-Waddington effect): on that view, the Baldwin effect assumes that the learned trait eventually becomes part of the genome.

The *extended* version of the Baldwin effect (what could be called the Baldwin-Deacon effect): on that view, the Baldwin effect must be construed in terms of *niche construction*.

Let us begin with some remarks on the narrow version. This is essentially the traditional view of the Baldwin effect. We see two major problems with it. The first is the one pointed out by Simpson in 1953, namely that such an effect, while theoretically plausible, is bound to be rare in

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<sup>3</sup> It seems to us that Downes (2003) commits just that kind of mistake. He defines the Baldwin effect in a very narrow way, argues that there are no documented and uncontroversial cases of the Baldwin effect, and then concludes it is not justified to extend evolutionary theory so as to include the Baldwin effect as one of its mechanisms. In our view, this comes close to being a straw man fallacy.



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nature. If that is the case, then we also see no cogent reason to make such a big fuss about the Baldwin effect. But our second issue with the narrow version is even more substantial. It has to do with what can be called the *modularity* assumption of this version; that is, the idea that a trait which used to be learned can become innate in such a way that there is a given set of genes (or an *organ* or a *module*, depending on one's terminology) that code *specifically* for this trait. Such an assumption rests on a dichotomous view of biology according to which one can easily distinguish between what's learned and what's innate. Given our sympathy for DST (Oyama, Griffiths, and Gray 2001), which stresses, among other things, the importance of all the causal resources contributing to the ontogeny of phenotypes, we claim that this assumption is highly questionable. It seems to us to be an extremely difficult task to partition the causes of phenotypes into clear-cut categories (i.e., *learned* versus *innate*) the way this version assumes it can be done. In fact, from a DST perspective the case can even be made that no trait is ever entirely innate, for no trait can unfold without the input of many environmental resources (Griffiths and Gray 1994). For instance, Nijhout (2001) shows that even with something as simple as sickle-cell anemia, there is *no such thing as a one-to-one correspondence between genes and phenotypes*; this trait seems to be so sensitive to the developmental context in which it unfolds that any minor change in one of the ontogenetic parameters can completely modify how (or even whether) the trait develops. Schaffner (1998) demonstrates the same thing with regard to the behavior of the nematode *C. elegans* and suggests that, if there is no simple genotype-phenotype relationship for the behavior of simple organisms, the same is very likely to be true for the behavior of more complex organisms like us.

*But the narrow version need not be the only way of understanding the Baldwin effect.* Another way to view it is as outlined in the extended version above. We owe this construal of the Baldwin effect in terms of *niche interpretation* to an illuminating paper by Godfrey-Smith (2003), who credits Deacon (1997) for having been the first to view the Baldwin effect in such a way. Interestingly, Deacon (2003) seems to agree with Godfrey-Smith's interpretation. Moreover, other theorists (Griffiths 2003) argue that the extended version is more in line with what Baldwin had in mind than the Baldwin effect as narrowly conceived. Before explaining what it means to understand the Baldwin effect in terms of niche construction, it is worth pointing out that the extended version of the Baldwin effect *encompasses* the narrow version but does not necessarily *imply* it. Thus, some of the examples of the Baldwin effect that did not fit with the narrow version might be incorporated into the extended version.

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### **3.1. Two definitions of niche construction**

Our contention that the Baldwin effect should be understood in terms of niche construction can be convincing only insofar as we clearly define what is meant by niche construction. Thus, we propose two definitions of niche construction, both of which draw heavily from a recent book by Odling-Smee, Laland, and Feldman (2003). Here is a first general definition of the Baldwin effect:

*General definition of niche construction:* Process whereby organisms modify their environment, which may result in a change in the selective pressures of such organisms, which in turn may affect how natural selection operates in this population.

The classic example illustrating this first definition of niche construction is that of beavers building dams. Odling-Smee et al. (2003) make it clear that this kind of niche construction has an impact on at least three different levels. First, it affects the other beavers in this specific environment. But it can also have an impact on some of the other species in that environment. Indeed, one can imagine a species of fish having to get around a dam to reach its source of nutrition. Finally and most importantly, niche construction thus understood is likely to affect not only the offspring and descendants of beavers, but also the offspring and descendants of some of the other species in that environment. Odling-Smee et al. refer to this last process as ecological inheritance. They claim that, under certain circumstances, niche construction in general and ecological inheritance in particular may involve changes in the environment that are so important and profound that they literally modify the selective pressures that will prevail for these species in their future environment. Moreover, such processes, which were neglected for too long in evolutionary theory (Lewontin 1983), are likely to have deep evolutionary consequences; they may completely modify or redirect the evolutionary trajectories of certain species. In this sense, niche construction is more than the mere work of natural selection; it is more than a mere *extended phenotype*, as Dawkins (1982) would say. It is a process with a causal efficacy of its own and one co-contributing, with natural selection, to the evolutionary process.

What is even more interesting for our purposes is that niche construction has a dynamic of its own in organisms possessing culture. And we happen to believe, like Godfrey-Smith (2003: 65), that the Baldwin effect is likely to be particularly useful in explaining social behaviors. So here is a second, more specific definition:

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*The Baldwin effect defined as cultural niche construction:* A process whereby organisms possessing culture modify their social and cultural environment; in doing so, they may change the selective pressures of their environment, which may result either in:

- (1) a change in the cultural traits and behaviors of the individuals of this population;
- (2) a change at the anatomical, neurological, or genetic level in the individuals of this population;
- (3) both (1) and (2) – not necessarily at the same time, though.

The Baldwin effect understood as a cultural niche construction seems to us to be of the utmost importance. It is a way for cultural organisms to cope with evolutionary problems prevailing in their environment by modifying and re-engineering their social and cultural ecology. When this happens, certain cultural traits and behaviors may become part of the *developmental matrix* (Sterelny 2003: 172) of the members of this population, matrix which is transmitted from one generation to the next; that is, such traits and behaviors form the background against which the ontogeny of these organisms takes place, just as dams are part of the environment of beavers. This process is made possible and enhanced thanks to cultural transmission (Boyd and Richerson 1985). In the following section, we appeal to Deacon's account of the evolution of language to illustrate how a Baldwinian process of cultural niche construction operates. Then, in section 5 we attempt to demonstrate that the evolution of social norms can be understood along the same lines.

In what sense can all of this still be seen as the Baldwin effect? In other words, what's our rationale for extending the Baldwin effect in such a way? First of all, the extended version still captures the essence of the Baldwin effect as narrowly construed but without its pitfalls. On the one hand, plasticity and learning are still likely to play a fundamental role in the process of modifying and re-engineering a population's environment, whether it be social, cultural or physical. On the other hand, some elements of this engineering process are transmitted and become part of the developmental matrix of organisms, but we don't have to assume that they are coded in the genome. In fact, from a DST perspective it is of secondary importance to try to find out whether the elements are *assimilated* at the genetic, neuroanatomic, or cultural levels, for all these levels are causally interdependent.<sup>4</sup> As long as the cultural traits and behaviors are

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<sup>4</sup> Of course, for certain analytical purposes it can be very important and useful to stress the separate contribution of different causes. For instance, in the case of the evolution language à la Deacon (1997; 2003), it is worth pointing out that changes in the cultural environment (situation 1 above) led to changes at the neuroanatomic level (situation

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reliably re-constructed and transmitted from one generation to the next, then suffice it to say that these “*facultatively acquired behaviors become entrenched in the social life of the population.*” (Godfrey-Smith 2003: 63). Which points to our second justification for the extended version of the Baldwin effect, namely that it applies to a much larger class of phenomena than the narrow version, which is too restrictive. For this reason, its explanatory scope is enhanced. For instance, it seems to us that the two examples mentioned before (lactose tolerance and resistance to malaria) can now be accounted for using the extended version of the Baldwin effect. Moreover, we argue below that the extended version is particularly useful to explain the evolution of language and social norms.<sup>5</sup> Our final reason for extending the Baldwin effect in such a way is that this new version is consistent with recent works in evolutionary theory. For instance, it fits with many of the claims made by DST advocates, who stress the role of epigenetic inheritance (e.g., ecological inheritance) and call our attention to processes and phenomena that have been neglected in a gene-oriented theory of evolution.<sup>6</sup> It is also in line with a multilevel view of selection (Sober and Wilson 1998; Deacon 2003) according to which natural selection does not merely occur at the genetic level but can also occur at many levels of the biological hierarchy.<sup>7</sup>

#### **4. Cultural Niche Construction and the Evolution of Language: Deacon’s account**

It is now time to turn to Deacon’s (1997; 2003) works on the evolution of language, our goal being to illustrate how cultural niche construction operates before we focus on our main example in the following section. Our analysis of Deacon’s account is admittedly quite superficial and incomplete. Doing justice to all its details and complexity is beyond the scope of this paper. In any case, the details are not crucial here as we are more interested in the *type* of explanation put forward by Deacon, which Deacon himself views as an example of niche construction in a

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2 above; thus also situation 3). In the case of the evolution of social norms, we are rather skeptical that major changes took place at the genetic or neuroanatomic levels as a result of changes in the cultural environment. But we wish to remain agnostic on this issue here.

<sup>5</sup> We conjecture that it might be useful to explain many other phenomena, though no attempt to back up this claim will be made here.

<sup>6</sup> In fact, we know of at least one DST theorist (Griffiths 2003) who seems to argue that Baldwin himself was more interested in epigenetic inheritance than genetic assimilation *per se*.

<sup>7</sup> Obviously, we are more interested in the process underlying the extended version than in the name “Baldwin” itself. Therefore, if one is unable to overcome one’s impression that the Baldwin effect necessarily implies a process of genetic assimilation as described in the narrow version, then one should just set Baldwin aside and call the process niche construction. Or, alternatively, one could refer to what we are proposing as a move “beyond the Baldwin effect.”

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recent article (Deacon 2003).<sup>8</sup> For the sake of analysis, we divide the story told by Deacon into three main phases; we do the same thing with the evolution of social norms in the next section. As anyone acquainted with the works of Deacons knows, his account eschews any simplistic cause and effect analysis. Clearly, the three phases are intertwined and interdependent.

*Phase 1: Some of the evolutionary problems that triggered the evolution of language.* For Deacon, the evolutionary problems that preexisted any forms of symbolic communication and that eventually paved the way for the evolution of such forms are essentially social problems. More specifically, they were problems having to do with the social organization of the group. Given our aim and the limits of this paper, we can only mention the main ones very briefly. Groups got bigger and bigger, which called for more coordination between the members of such groups. There was also a need for a better division of labor not only between men and men (e.g., for hunting), but between men and women; for instance, men became more and more invested in the education of their offspring, but because they had to hunt in big groups the issue of sexual exclusivity arose; how, indeed, could men ever be sure that their women were not sexually promiscuous when they were away. Finally, in such a harsh and changing environment (see section 5.1 below), there was an increased pressure to find a way for parents to transmit crucial information to their offspring, information that would be conducive to their fitness.

*Phase 2: A Baldwinian process of cultural niche construction.* The existence of all these evolutionary problems (and more) created the conditions for a new social and cultural niche to arise with its own selective pressures. This is the most fascinating aspect of Deacon's thought. The first forms of symbolic communication emerged as a solution to problems that are social in nature. On this view, the emergence of symbolic communication must be thought of as a solution to a problem of social engineering. More precisely, the evolution of symbolic communication is the outcome of important social changes and arrangements whose goal was to ensure more cooperation between the members of the group, stabilize the relationships between men and women, and favor social transmission and social cohesion. In other words, the rise of symbolic communication was made possible thanks to changes made to the social environment. But that is not the end of the story for Deacon. Once these changes were made and that the first forms of symbolic communication emerged, linguistic evolution itself (Deacon 2003) became a cultural

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<sup>8</sup> What is more, one may not be in total agreement with some of the details of Deacon's account while still thinking that the type of explanation put forth is the right one. For instance, one may not share Deacon's view on the importance of marriage in the evolution of symbolic communication.

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niche exerting its own selective pressure and triggering profound changes at many levels. Symbolic communication was the new cultural niche of hominids for Deacon (2003: 93) “*The social evolution and transmission of symbolic communication [...] created a radically different niche than that experienced by our non-symbolic ancestors, the australopithecines and other apes.*” Which led to the third phase.

*Phase 3. Changes at the cognitive and neuroanatomic levels, and universality of language.* In fact, linguistic evolution was so powerful on Deacon’s account that it brought about the main physical changes necessary for language to become a universal phenomenon. Among other things, this included a greater ability to memorize; an expansion of the frontal lobe; an ability to analyze phonemes; a new position of the larynx; a greater ability to imitate the voice of others; and so on (Deacon 1997). Reflecting on his approach to the evolution of language developed in *The symbolic species*, Deacon (2003: 94) says:

So, in a way not radically dissimilar to the way the construction of beaver dams led to an evolutionary change in beaver anatomy and physiology, making them more aquatic, the human-created niche we call culture had its primary influence on neurologically based systems. I have argued that the major neuroanatomic differences that distinguish humans from other apes, other primates, and from mammals in general, are the anatomical effects produced by this radical niche construction.

What are the key points to glean from Deacon’s story? As far as the *type* of explanation proposed is concerned, the story fits nicely with an explanation in terms of cultural niche construction as described above.<sup>9</sup> Thanks to modifications made to the social and cultural environments of hominids, new selective pressures were created which in turn led to physical changes in hominids. Furthermore, the story offered here still captures the essence of the more traditional version of the Baldwin effect. While plasticity and learning understood in terms of social and cultural engineering obviously play a role in such a scenario, there is no denying that language has become part of the developmental matrix of human beings.<sup>10</sup> However, for Deacon this need not have involved a process of genetic assimilation — there is no organ or

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<sup>9</sup> Deacon’s story raises the question of the relationship between the social and the cultural. Roughly, here is our perspective on this issue. The social preceded culture and was necessary for it to evolve. In this sense, no culture without a social life. However, the reverse is not true. Many species no doubt have a social life (e.g., insects) but lack culture. Having said this, none of this implies that in species in which culture emerged, culture became prior to the social. Culture is just an additional process (i.e., an additional layer of causation) on top of the social, one which, under certain circumstances, can work in conjunction with the social to bring about evolutionary phenomena that can hardly exist in species lacking culture (e.g., symbolic language, social norms).

<sup>10</sup> Interestingly, Pinker (1994) also relies on the Baldwin effect in his analysis of the evolution of language. However, in his case a standard and narrow version of the Baldwin effect seems at work, in that a process of genetic assimilation occurs which results in a /language instinct. Needless to say, Deacon rejects such a view.

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module for language *per se*. In addition to learning, the selective pressures of linguistic and cultural evolution are *still* as causally important in the ontogeny of language as are the more “biological” constraints.

## **5. The evolution of social norms and cultural niche construction**

We now want to apply the same type of explanation to the evolution of social norms. Social norms are essentially rules stating how one should behave in a given cultural group. There are two sides to the coin with social norms, namely, they forbid certain types of behavior but they also encourage other types of behavior (Boehm 1999; Nichols 2002). The universality of social norms constitutes a puzzle. Why is it the case that such rules prevail in all cultural groups? Moreover, how is it possible that these norms often overlap from one group to the other? That is, most groups typically forbid the same kind of behavior (i.e., rape, murder, incest, theft, lies, etc.) while also favoring the same kind of behavior (i.e., generosity, cooperation, a division of labor, etc.).

There are at least three possible ways of explaining this puzzle. First, there is the biological (or sociobiological) hypothesis: social norms are innate. The problem with this hypothesis is that there seems to be little empirical evidence to support it. Moreover, we are rather skeptical vis-à-vis the possibility of specific modules *encapsulating* specific behaviors and psychological dispositions (see Poirier, Faucher, and Lachapelle, manuscript). At the other extreme of the continuum would be the environmentalist hypothesis: social norms have emerged in function of the demands of the local environment. The problem with this hypothesis lies in the relative homogeneity of social norms, given the fact that the environments of hominids seems to have been *heterogeneous* over time and space (Potts 1996; Boehm 1999; Sterelny 2003); what, then, could explain this convergence of social norms? A third and, we believe, more plausible explanation is the cultural niche construction hypothesis: social norms have evolved in hominids as a result of major modifications to the social and cultural environment, modifications which have been transmitted, reinforced and accelerated by a process of cultural evolution (Boyd and Richerson 2002).

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### **5.1. The three phases in the evolution of social norms**

Here again we divide the evolution of social norms into three phases. It is worth pointing out that this is done for analytical purposes and that we are aware that such a process occurred over a period of at least two million years in the hominid lineage. As is the case with all the explanations of the evolution of human cognition, the scenario offered here is bound to be fairly speculative (Sterelny 2003). We contend that such scenarios should be assessed in terms of degrees of plausibility given the evidence available. Moreover, while one may want to take issue with some of the specific points mentioned in this story, one may nevertheless agree with the type of explanation proposed in terms of cultural niche construction.

*Phase 1: Some of the evolutionary problems that triggered the evolution of social norms.* We identify two general sets of problems in this phase. Clearly, these two sets of problems are intertwined and interdependent so that no simple cause and effect analysis can do the job here. A first set of problems can be referred to as *environmental* problems. As is now well documented (Potts 1996; Richerson and Boyd 2000), our ancestors had to live in an environment in which dramatic climatic changes occurred at a fast pace. In a recent book, Sterelny (2003: 128) refers to this problem as the “ecological trigger of hominid evolution”, which he describes as follows:

Hominid evolution took place in a world that was becoming increasingly inhospitable to ape-like ways of life. Hominids evolved in a habitat of increased seasonality and aridity, changes involving the transition from forest to savannah and open woodland. These changes reduced resources that were at the core of ape life, in particular the ripe fruit on which chimp diets are based.

This summarizes in a concise way the major environmental problems that arose in the hominid lineage. The rapid and important climatic changes forced hominids out of the forest. That resulted in a change of habitat which called for a new diet. While in the forest hominids mainly ate fruits, but now out in the open in the savannah they had to adopt a meat-oriented diet. Obviously, obtaining the necessary meat required hunting animals, but that exposed our ancestors to predators (Sterelny 2003). All of these environmental problems thus raised some *social* problems, which is the second set of problems in phase 1. Indeed, hunting and a greater exposure to predators had at least two major consequences. On the one hand, they called for bigger groups as security lies in number, a predator being less inclined to attack a group of thirty people (Dunbar 1999) than a couple of individuals. On the other hand, they also required hunting and defense strategies — in other words, more coordination and cooperation were necessary in groups getting bigger and bigger.



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These are the environmental and social conditions that triggered two additional social problems in phase 1 which are key to understanding the evolution of social norms. The first one is known as the freerider problem (Dunbar 1999). Freeriders are essentially individuals that want to benefit from the advantages of social life without incurring the costs associated with it; for instance, an individual might want to eat the meat collected by other members of the group, while not being willing to share after catching a prey himself (e.g., he may hide to eat the meat). In a big group, it is harder to monitor the behavior of all individuals, so freeriders can more or less go around without getting caught. If many individuals reason along the same lines, then this might undermine the very possibility of cooperation that is so crucial for a group living in a harsh environment. In short, freeriders are potentially quite disruptive for the group and likely to be the source of conflicts. Exactly the same can be said about the second problem, which has to do with individuals with alpha-type behaviors. A natural disposition to seek power and dominance has been observed in humans, just as it has been observed in other primates (de Waal 1999; Boehm 1999; 2000). What this means is that human nature is such that, if given the opportunity, most individuals are inclined to use power to dominate other individuals. In concrete terms, this may give rise to situations in which one (or a couple) of individual has access to all the females; gets more food (or better quality food) than the other members of the group; makes self-serving decisions for the group at the expense of the other members of the groups; etc. (Boehm 1999; 2000). If that is that case — that is, if we assume that there is such a natural disposition and that all the other problems mentioned also prevail —, then such alpha-type behaviors are bound to be disruptive for the group and the source of great tensions that are likely to undermine any attempt at cooperation; specifically, such behaviors favor *within*-group selection (i.e., more *competition* within the group; Sober and Wilson 1998; Boehm 1999) at the expense of cooperation. Yet cooperation is exactly what was needed to make it in that kind of environment.

*Phase 2: A Baldwinian process of cultural niche construction.* How, then, are we to suppose that people came out of a situation that can only be described as a vicious circle? Here again we want to suggest that the evolutionary problems of phase 1 called for a solution that is best thought of in terms of *social engineering*. Specifically, it is hypothesized that hominids made some substantial modifications to their social and cultural ecology that allowed them to cope with these evolutionary problems. Anthropologist Christopher Boehm (1999; 2000), whose works inform

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much of what follows in phase 2, refers to this process as the rise of *egalitarianism*, which resulted in the following changes:

a) *The emergence of leveling mechanisms limiting the power of individuals with alpha-type behaviors.* Based on his rich and comprehensive survey of the ethnographic literature, Boehm (1999; 2000) concludes that all cultural groups (either nomadic or foraging) have come up with rules and strategies designed to constrain the freedom and power of individuals with alpha-type behaviors. Such leveling mechanisms, as Boehm calls them, are there to ensure that no individual gets to have his cake and eat it at the same time; for instance, rules concerning the sharing of meat and sexual exclusivity (e.g., marriage rules) are clearly established in several groups. Boehm suggests that cultural groups dealt with the problem of alpha-type behaviors by developing a group aversion to within-group conflict and to dominance; in short, they modified their social ecology. In a series of fascinating paper, Paul Bingham (1999; 2000) goes one step further by arguing that weapons also played a fundamental role in limiting the power of individuals with alpha-type dispositions. While originally conceived to hunt, weapons were soon used as a threat by the group to prevent these alpha-type individuals from gaining too much power.

b) *The implementation of punishment mechanisms for freeriders and individuals with alpha-type behaviors.* In all cultural groups rules and strategies exist to punish individuals that are perceived as disruptive for the group and undermining the social fabric (Boyd and Richerson 1992; Boehm 1999; 2000). These mechanisms range from mere gossip to ridicule to ostracism, all of which have dire consequences for such individuals in the kind of environment in which the hominid lineage evolved. If push comes to shove, capital punishment is also an option (Boehm 1999). The major consequence of implementing punishment mechanisms is obvious: it sends a clear message to all would-be freeriders and alpha-type individuals that such behaviors are very costly in groups in which such rules prevail.

c) *Rise of values and rules promoting cooperation within certain groups.* As was mentioned before, social norms have two dimensions. They also include a positive dimension which amounts to encouraging certain behaviors. Just as such groups are willing to punish disruptive individuals, so they are inclined to reward individuals whose behavior is conducive to the group's well-being. This goes some way toward explaining why certain values and rules fostering cooperation and generosity can be observed in so many cultural groups. These values and rules typically have to do with things such as strategies for hunting, meat-sharing, the division of labor, sexual exclusivity, the raising of offspring, or some arrangements for taking care of the elderly, and so

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on. When such values and rules are promoted and become part of a group's ethos (Boehm 1999), they clearly facilitate group-coordinated actions against freeriders and alpha-type individuals.

*d) Transmission and reinforcement of these values and rules through cultural evolution (Boyd and Richerson 1985; 2004, chapter 6).* A species that would modify its social ecology but that would not be able to pass on these changes to its offspring and future descendants would presumably have to start from scratch every generation. This is not the case for species possessing culture, most notably human beings. We see two main advantages to having culture in the context of our discussion. The first advantage is that it allows an accurate transmission of the rules and values prevailing in a group (both the positive ones geared towards cooperation and the negative ones pertaining to punishment) from one generation to the next. When cultural transmission happens, it amounts to engineering the social ecology of offspring and future descendants in this cultural niche. In this sense, just as Deacon made it clear with linguistic evolution (see section 4), culture becomes its own selective pressure shaping the ecological niche of future generations. As Boehm (1999: 244) puts it, “*cultural traditions have their own strong effect. They are free to reinforce certain aspects of human nature, and to suppress others.*” But that is not all. Not only does culture allow the transmission of certain crucial rules and values, but it also makes possible the reinforcement and improvement of such rules and values. This is the second advantage, namely, culture can *evolve* and accumulate the changes made to the social ecology. Tomasello (1999) refers to this process as the “ratchet effect”: just as much as it is possible for improvements in tools and weapons to be transmitted and accumulated, so it is possible for cultural changes and improvements to be passed on and accumulated, thereby engineering the social environment of future generations (see Boyd and Richerson 2004). In short, cultural niche construction is often cumulative. Some examples of the cumulative improvement of cultural adaptations are given below in phase 3.

*e) Emergence of conditions favoring group selection (Sober and Wilson 1998).* Though there is little empirical evidence supporting group-selection hypotheses in non-human animals, it is safe to surmise that the deck was stacked in favor of group selection in a species in which conditions (a) to (d) prevailed. Roughly, two of the basic conditions for group selection to occur in the Sober-Wilson model are satisfied in this scenario. On the one hand, the effect of having punishment mechanisms for freeriders is that it reduces *within*-group selection. In such groups it does not pay off to be a freerider or an alpha-type individual. On the other hand, rules and values promoting generosity and cooperation *enhance* between-group selection. This is also reinforced thanks to

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cultural evolution, which tends to favor conformism and imitation within groups (Boyd and Richerson 1985; 1992; 2002). Together, these two conditions make it likely that cultural group selection played a central role in human evolution (Sober and Wilson 1998).

*Phase 3: The presence of social norms in all cultural groups.* This phase is the end product of this long process of cultural niche construction. It demonstrates the universality of social norms and goes some way towards explaining why social norms fulfill a similar function in all cultural groups. Let us briefly mention some of the final changes brought about by this Baldwinian process of niche construction:

a) *Groups having established the values and rules mentioned in phase 2 are imitated by other groups.* In a recent paper, Richerson, Boyd, and Henrich (2003) make a strong case for the idea that social norms spread from one group to the other thanks in part to imitation. Their group-selection inspired argument is that groups without such norms were not evolutionarily competitive vis-à-vis groups with such norms. It is indeed easy to imagine why groups with many freeriders are less likely to be cohesive and cooperative enough to compete against groups with little within-group selection. Accordingly, one of two possibilities seems to have been possible in that context. Groups outcompeted by cooperative groups were either merged to them; or they decided to imitate the cooperative groups by modifying their social ecology and implementing social norms. It seems to us to be plausible that they often adopted the second strategy.

b) *Emergence of language as a system ensuring the transmission of social norms and facilitating their application* (Dunbar 1999; Boehm 1999; 2000). Language as we know it today most likely emerged late in the Paleolithic. Of course, language serves many purposes. But it is fair to assume that it facilitated the application and transmission of social norms. For instance, language is a reliable system of transmission. And in this sense it can be used not only to spread social norms to all members of the group, but also to future generations. Moreover, it increases the potential for a good coordination among members of cultural groups. Specifically, it makes it easier for a group to monitor the behavior of potential freeriders (e.g., they can set up a strategy while he is away). Language also increases the pace at which information is transmitted. And speed is of the essence when it comes to dealing with freeriders. A group might as well punish its freeriders before they even begin to disrupt the group; by then, it's often too late and within-group selection has taken over.

c) *Institutionalization of social norms and formation of political and moral communities promoting cooperation and altruism.* The creation of institutions designed to regulate and apply social norms is no doubt a

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recent invention in human evolution and a paradigm example of a cultural adaptation that is the outcome of a process of cumulative improvements. Such institutions range from legal systems to political systems to jails and police forces. The role of these institutions in fighting freeriders and alpha-type individuals is obvious. No society tolerates serial killers and rapists, for instance. Such institutions probably evolved hand in hand with the rise of political and moral communities promoting cooperation and altruism. Such communities go beyond simple rules of punishments and rewards, in that they sometimes have the ability to carry out an ethical and political reflection on themes such as the well-being of the group as a whole, equality, justice, fairness, and so on, which sometimes results in concrete measures taken to bring about social changes. In the best case scenario, that kind of reflection sometimes extend beyond the boundaries of one's own cultural group and focuses on the well-being of humanity as a whole, which is a kind of reflection that must have been totally alien to the way of thinking of our ancestors.

In the end, the moral of the story is that social norms are part of the social and cultural environment of all human beings. They are the outcome of a long process of cultural niche construction and are embedded in the developmental matrix of human beings, just as dams part of the developmental niche of beavers. In this scenario, there is no *gene for* or *module* for social norms — yet such norms have become as part of human nature as language and sex. It seems to us that the basic Baldwinian insight — a mix of learning / plasticity and assimilation — is preserved in that scenario.

## **6. Conclusion**

We would like to conclude by going over some of the most important conclusions reached in this paper.

First of all, the Baldwin effect is probably not as important a factor in evolution as Baldwin and Conwy Lloyd Morgan sometimes suggested, in particular when they opposed learning to natural selection and claimed that the former is the main mechanism driving the latter. The Baldwin effect is not an alternative to natural selection; portraying it in such a way may even partly explain why it has a bad reputation in some circles.

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We also argued that genetic assimilation is not a requirement of the Baldwin effect; rather, the Baldwin effect should be construed in terms of niche construction, which is a process with an evolutionary dynamic of its own in organisms possessing culture (Odling-Smee, Laland and Feldman 2003). This new interpretation, while extending the Baldwin effect, nevertheless preserves its original insight, namely a mix of learning and plasticity on the one hand, and an assimilation of certain traits and behaviors into the developmental matrix on the other — that is, certain traits and behaviors become part of human nature without assuming that there is a specific set of genes, a module, or an instinct *coding* for such traits and behaviors.

Construed as niche construction, the Baldwin effect may not be the discovery of an entirely new mechanism affecting evolution by natural selection, as some enthusiastic “Baldwin boosters”<sup>11</sup> may be inclined to think; rather, it is a process that has been neglected for way too long in evolutionary theory (Lewontin 1983; Odling-Smee, Laland and Feldman 2003). Accordingly, it has a role to play in an extended version of evolutionary theory and is consistent with other approaches urging us to extend the framework of evolutionary theory, most notably multilevel selection theory and DST. Our approach is also consistent with *certain* theories of evolution in terms of gene-culture co-evolution, most notably that of Boyd and Richerson. For instance, in their work on the evolution of cooperation, Boyd and Richerson (2004; see also Richerson, Boyd, and Henrich 2003) hypothesize that social institutions played a crucial role in the shift from *social* instincts to *tribal* instincts, a shift that paved the way for a greater degree of cooperation and altruism in humans. Clearly, the creation of such social institutions can be viewed as a typical case of cultural niche construction.<sup>12</sup>

If understood in terms of niche construction, the Baldwin effect cannot be reduced to natural selection, as though it was merely the product of the latter. Niche construction is very much part of the *process* of evolution by natural selection. It has a causal efficacy of its own and thus co-contributes, with natural selection, to the evolutionary process (Odling-Smee, Laland, and Feldman 2003). It is in this sense that it differs from a standard version of neo-Darwinism. Finally, construed in terms of cultural niche construction, it is very likely that the Baldwin effect played a fundamental role in the evolution of language and social norms – and possibly in the

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<sup>11</sup> We owe this expression to Godfrey-Smith (2003), but he isn’t one of those naïve Baldwin boosters.

<sup>12</sup> However, we would like to point out that other theories of gene-culture co-evolution are *not* congruent with our approach because they attribute a causal primacy to the genetic level of inheritance and downplay the causal efficacy of culture (see, for instance, Lumsden and Wilson 1981). Which is why we find the reference to theories of gene-culture co-evolution somewhat tricky.

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evolution of many other cultural traits and behaviors, which is why the extension of the Baldwin effect we proposed fits in with the EEM programme. The demonstration of this is the subject of another paper, however.

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