

Re: The Baldwin Effect: What is it trying to say?

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Newsgroups: sci.bio.evolution

From: Guy Hoelzer <hoel...@xxxxxxx> – Find messages by this author

Date: Mon, 5 Dec 2005 23:07:27 -0500 (EST)

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Subject: Re: The Baldwin Effect: What is it trying to say?

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I hope this thread gets plenty of attention. I am very interested in the Baldwin effect myself and would like to understand it better.

in article dmve35\$kv...@xxxxxxxxxxxxxxxxxxxxx, whitesic...@xxxxxxx at whitesic...@xxxxxxx wrote on 12/4/05 10:55 AM:

- > Apparently the Baldwin Effect has some efficacy in computational models
- > but I do not understand mathematics and I think computational modeling
- > by itself is insufficient to make the evolutionary point. First, I read
- > Baldwin's theory was intended to replace Lamarck's theory of aquired
- > characteristics.

It might have that effect, but I don't think that was the goal.

Response: Yes I agree. I continue to believe it has had minimal effect on Darwinian evolution but it has been its staying power which makes me wonder what is behind it.

- > Second, I read Baldwin's Effect was associated with
- > genetic assimilation and canalization but some researchers now are
- > saying it doesn't depend on genetic assimilation.

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I think the point of genetic assimilation and canalization under the Baldwin effect was that these are means of codifying (making more permanent) adaptive responses to environmental challenges that are plastic in individuals. Perhaps the researchers suggesting that the Baldwin effect does not depend on these mechanisms have discovered or imagined other codifying mechanisms.

Response: Baldwin's Effect is critiqued by some scientists as "social heredity" and "niche construction".

- > Very strangely, the
- > general point of Baldwin seems to be the phenotype(s) plasticity and
- > effecting "changes" in it with no direct connection between phenotype
- > and genotype. I'm inclined, unless it can be shown otherwise, the
- > Baldwin Effect has had minimal effects on evolution.

IMHO there is no DIRECT connection between genotype and phenotype. Development of phenotype is affected by an interaction between the genome and the environment. Personally, I see the Baldwin Effect as potentially very important in evolution. It might even be one of the most fundamental aspects of evolutionary adaptation in the sense that mutations may rarely be beneficial independent of the plastic behaviors expressed in the population. I think this remains an open question.

Response: I will concede there is no straight line connection between genotype and phenotype. I agree the development of phenotype is affected by an interaction between the genome and the environment. However, I believe in Darwinian evolution phenotypes created from the interaction of the genome and the environment are not significantly dependent on the Baldwin Effect. You write, "Personally, I see the Baldwin Effect as potentially very important in evolution. It might even be one of the most fundamental aspects of evolutionary adaptation in the sense that mutations may rarely be beneficial independent of the plastic behaviors expressed in the population. I think this remains an open question." It depends on what your definition of "plastic" is. Check out my exchange with Dr. Felsenstein in the thread "Behavioral Genetics: Pseudo-science or scientific discipline" (I believe). It addresses the issue of phenotypic plasticity by polymorphism of two (or more) phenotypes. Maybe the Baldwin effect could play some role here. I think mutations can be

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beneficial without relying on plastic behaviors expressed in the population. For example, some mutations in our ancestral past may rarely be beneficial independent of the "plastic" behaviors expressed in the population. But what was "plastic" in our ancestral past is today "rigid" and this is a product of canalization...not "genetic assimilation".

- > Learning is the most cited example of Baldwin's Effect. Yet ever since
- > recorded civilization humans have remained basically unchanged by
- > Darwinian evolution.

Wow. I find this to be wildly at odds with my personal viewpoint. What reasoning or evidence do you have to support this claim.

Response: You've always struck me as a "positive person". I'm not suggesting your scientific judgement is directly effected by it but I think it does have an influence. I don't have alot of evidence. There are some people I admire and I use them to make my point. This reveals that I'm influenced by them. I will quote Hawking here to answer your question:

"But with the human race, evolution reached a critical stage, comparable in importance with the development of DNA. This was the development of language, and particularly written language. It meant that information can be passed on, from generation to generation, other than genetically, through DNA. There has been no detectable change in human DNA, brought about by biological evolution, in the ten thousand years of recorded history. But the amount of knowledge handed on from generation to generation has grown enormously. The DNA in human beings contains about three billion nucleic acids. However, much of the information coded in this sequence, is redundant, or is inactive. So the total amount of useful information in our genes, is probably something like a hundred million bits. One bit of information is the answer to a yes no question. By contrast, a paper back novel might contain two million bits of information. So a human is equivalent to 50 Mills and Boon romances. A major national library can contain about five million books, or about ten trillion bits. So the amount of information handed down in books, is a hundred thousand times as much as in DNA.

Even more important, is the fact that the information in books, can be changed, and updated, much more rapidly. It has taken us several million years to evolve from the apes. During that time, the useful information in our DNA, has probably changed by only a few million bits. So the rate of biological evolution in humans, is about a bit a year. By contrast, there are about 50,000 new books published in the English language each year, containing of the order of a hundred billion bits of information. Of course, the great majority of this

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information is garbage, and no use to any form of life. But, even so, the rate at which useful information can be added is millions, if not billions, higher than with DNA.

This has meant that we have entered a new phase of evolution. At first, evolution proceeded by natural selection, from random mutations. This Darwinian phase, lasted about three and a half billion years, and produced us, beings who developed language, to exchange information. But in the last ten thousand years or so, we have been in what might be called, an external transmission phase. In this, the internal record of information, handed down to succeeding generations in DNA, has not changed significantly. But the external record, in books, and other long lasting forms of storage, has grown enormously. Some people would use the term, evolution, only for the internally transmitted genetic material, and would object to it being applied to information handed down externally. But I think that is too narrow a view. We are more than just our genes. We may be no stronger, or inherently more intelligent, than our cave man ancestors. But what distinguishes us from them, is the knowledge that we have accumulated over the last ten thousand years, and particularly, over the last three hundred. I think it is legitimate to take a broader view, and include externally transmitted information, as well as DNA, in the evolution of the human race."

- > Our "learning" or education has increased as has
- > our knowledge but genetically we haven't much.

I suppose the word "much" is subjective, so there is room for differing

opinion on this claim. In my estimation, the human gene pool has changed enormously over the past few thousand years, given the constraints on gene pool evolution that accompany rapid population growth. I think that gene pools tend to change much more dramatically during times of population contraction, given the same selection pressures.

Response: Well your a biologist and Hawking a theoretical physicist. I guess you no more or perhaps what you call gene pool evolution over the past few thousand years is different from DNA evolution.

- > Therefore, there hasn't
- > been any evidence of Baldwin's Effect on Darwinian evolution as I see.
- > If one defines evolution to also entail cultural evolution then I would
- > argue Baldwin's Effect has had some effect on evolution...but not a
- > whole lot.

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Well, yes I would certainly include cultural evolution in this subject, because individually plastic behaviors can become codified as cultural practices.

Response: As Hawking stated?

- > The only way I see Baldwin's Effect having a significant
- > effect is if the continuation of learning and knowledge goes beyond the
- > idea of effecting changes in phenotypic plasticity without a direct
- > connection between phenotype and genotype.

Here is a classic, though somewhat hypothetical, illustration.

Pinnipeds

(seals and sea lions) evolved from canid ancestors.

Response: They did or this is part of the hypothetical scenario. I get the impression they did.

Imagine that the environment of the ancestral canid population changed such that this dog-like species was forced to forage for intertidal marine species, rather than say hunting for other large mammals (maybe in packs). This would be an example of behavioral plasticity.

Response: What was it which forced the canid to forage for intertidal marine species?

Now that these canids are depending on their ability to hunt for marine prey, any mutation that makes them better at doing so would be favored by selection.

Response: Yes.

Had the canids not manifested intertidal foraging behavior, this mutation would be of no value.

Response: Yes, but what caused the canid to be forced into intertidal foraging behavior?

Hence, this population of canids might have evolved into an early form of pinniped through the genetic codification of a behaviorally plastic change. Does this seem unlikely to you? I could see how it might seem like an unusual circumstance, but I would argue that we haven't explored this line of thinking well enough to reject it as a general phenomenon.

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Response: I think it is more complex.

- **Follow-Ups:**

- ◆ **Re: The Baldwin Effect: What is it trying to say?**

- ◇ From: Guy Hoelzer

- **References:**

- ◆ **The Baldwin Effect: What is it trying to say?**

- ◇ From: whitesickle@xxxxxxx

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