Darwinian Design: The Memetic Evolution of Design Ideas

John Z. Langrish

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Introduction

There seems to have been a recent slight increase in the number of design papers with the word, "evolution" in their titles. Unfortunately, these papers are either vague about what is meant by this word, or they use the word in a non-Darwinian sense which owes more to Spencer's version of progressive evolution than to the process of natural selection.

One interesting example is a paper by A. Can Ozcan, who writes:

> Let's assume that the one we know as Darwin is born in our times and he is very curious not about species but designed objects and artifacts. Instead of looking at birds he is looking at refrigerators, cars, kettles, microphones, bicycles. Our number one question is whether he would come up with similar principles of evolution like selection of the fittest or progression from simplicity to complexity for designed objects.[1]

My short answer to that question is an emphatic "No." The longer answer is that Charles Darwin did *not* come up with "principles of evolution," and if he had done so then progress towards complexity would not be one of them. The original full title of his great work was *On the Origin of Species by Means of Natural Selection*—nothing about "evolution." In fact, the word "evolution" is only used once in the first edition. He originally intended to call this work just "Natural Selection," and a Darwinian theory is one based on natural selection—not on some inevitable force for progress.

The term "survival of the fittest" was used by Herbert Spencer before Darwin was persuaded to copy it in later editions of his work. The notion of progress from simple to complex is a key part of Spencer's evolution, but it does not correspond with what we know. This paper suggests that Spencerian notions of progressive evolution have dominated discussions of evolution in design, and now it is time to examine what a Darwinian theory of design evolution might look like. Darwin, of course, did not know anything about genes, genetics, or mutation. The term neo-Darwinism is used

1 A. Can Ozcan, *An Evolutionary Approach for Design—Contradictory or Complementary with History* (3rd International Conference on Design History and Design Studies, Istanbul, 2002.)

to mean Darwin's natural selection plus genes. It is not suggested that design is somehow genetic. Design evolution is the evolution of ideas, and the Darwinian evolution of ideas is called "memetics" from the concept of self-replicating ideas called memes by Richard Dawkins.[2]

Four Arguments Against Evolutionary Design

A good example of the way in which design historians equate evolution with Spencerian notions of progress is provided by Adrian Forty's *Objects of Desire*.[3]

In his otherwise excellent attempt to tackle the problem of why artifacts are the way they are, Forty dismisses evolutionary explanations of change on the following grounds:

> Historians of design have often tried to get around the problem [of explanations involving creative individuals] by attributing the changes to some sort of evolutionary process, as if manufactured goods were plants or animals. Changes in design are described as if they were mutations in the development of products, stages in a progressive evolution towards their most perfect form. But artifacts do not have a life of their own, and there is no evidence for a law of natural or mechanical selection to propel them in the direction of progress. The design of manufactured goods is determined not by some internal genetic structure but by the people and the industries that make them and the relationships of these people and industries to the society in which the products are to be sold.[3]

Forty has four arguments against what he calls evolution. They may be good arguments against vague ideas of Spencerian evolution, but they are not valid arguments against Darwinian change. His four arguments are:

1. The progress argument. This has nothing to do with Darwinian change, but Forty does not restrict himself to the progress towards complexity mistake: he adds the astonishing "a progressive evolution towards their most perfect form." There is no such thing as a perfect mammal, perfect kettle, perfect car, or perfect tree. In all cases, they exist as different varieties which have to fit into different environments. "Progressive evolution towards a perfect form" is an example of what Ernst Mayr refers to as "finalism" or "the belief that the living world has the propensity to move towards ever greater perfection." According to Mayr, supporters of finalism "postulated the existence of some built in force... but Darwin emphatically rejected such obscure forces."[4]

2. "Artifacts do not have a life of their own." This argument is also known as the "machines don't mate" argument. The short answer to this is that the evolution of design ideas is the issue, and that ideas do have a "life."

2 Richard Dawkins, "Memes: The New Replicators," Chapter 11 in *The Selfish Gene* (Oxford: Oxford University Press, 1976), 189–201.

3 Adrian Forty, *Objects of Desire: Design and Society Since 1750* (London: Thames and Hudson, 1986), 8.

4 Ernst Mayr, *What Evolution Is* (London: Basic Books, edition: Phoenix, 2001), 82.

The machines don't mate argument was answered convincingly by Samuel Butler more than a hundred years ago. Butler's arguments were written in three chapters of his novel *Erewhon* (anagram of nowhere, and pronounced with three syllables). One of Butler's responses to "machines don't mate" was "Does anyone say that the red clover has no reproductive system because the humble bee must aid and abet it before it can reproduce? No one." Machines use humans to "aid and abet" them. He makes the obvious points about individual machines requiring feeding and tending by humans, but he also makes the much more subtle point that the improvement of machinery relies on competition, the destruction of inferior machines, and the creation of better machines. These three tasks all require the enslavement of humans. In Butler's words:

> The lower animals progress because they struggle with one another; the weaker die, the stronger breed and transmit their strength. The machines themselves being unable to struggle have got man to do their struggling for them; as long as he fulfils this function duly, all goes well with him—at least he thinks so; but the moment he fails to do his best for the advancement of machinery by encouraging the good and destroying the bad, he is left behind in the race of competition; and this means that he will be made uncomfortable in a variety of ways and perhaps die.[5]

Butler, of course, did believe in progress, and this lead him to part company with Darwin.

A modern answer to the "machines don't mate" argument would involve the fact that life on earth went on for about one-thousand million years before sexual reproduction appeared. The early bacteria mixed up their genetic material in a variety of ways including lateral transfer. This is more like the way in which design ideas mix together. Some of the bacteria which are around today are very similar to the ancient bacteria that first appeared about thirty-eight hundred million years ago. This does not suggest that Spencer was right in his ideas of progression.

3. The law of propulsion argument. Natural selection is *not* a law like the law of gravity: it does not propel things in some predetermined direction. It is a filter, which is different. If we have a mixture of different sizes and shapes of things being shaken on top of a sieve, then some things will pass through the sieve and some will not. The force at work here is the force of gravity, which is impartial. The sieve which "selects" things as being below a certain size is not a "force." Some things just pass through it, and some things don't. And there is a little luck involved here in that some small things which ought to pass through the sieve don't because they get stuck, and some large things which happen to be long and very thin manage to wriggle through. So there is no precise prediction of the separation.

5 Samuel Butler, *Erewhon: or Over the Range* (London: Jonathan Cape, 1872).

It took time for the difference between natural selection and some kind of propulsive force to be appreciated. In the early years of the twentieth century, there were several people postulating a "force." One was the French philosopher Henri Bergson, whose "creative evolution" was propelled by an *élan vital*—a vital impetus. According to the French art historian Germain Bazin, Bergson influenced art history. Referring to this influence of the "philosophy of Bergson," Bazin claims:

> Art historians, following a certain finalist tendency which showed itself particularly in neo-vitalist doctrines, began to seek the determining factors in the work of art no longer in circumstances outside the work, but in the artistic activity itself. They credited this activity with a capacity for development or expansion of its own, to be understood like life in terms of a "creative evolution" working towards a more efficient use of its inherent properties.[6]

Bergson's evolution, like Spencer's, has no evidence in its favor. Natural selection has more than a hundred years of evidence in its support.

4. The argument that manufactured goods do not have some "internal genetic structure." The short answer to this is to point out that Darwin knew nothing at all about genes or genetics, so whatever is meant by Darwinian change does not have to include some "internal genetic structure." Darwin, of course, was aware that something had to be passed on from one generation to another; otherwise natural selection would not work. However, his ideas about the nature of this "something" were confused. The modern term for a "something" that gets passed on is a "replicator" as popularized by Richard Dawkins, who points out that there must have been chemical replicators before the emergence of DNA, and also that human society rests on a new type of replicator which he calls a "meme"—a replicating idea.[2] Ideas that get copied, modified, and stuck together with other ideas can form the basis of a Darwinian theory of changing design. The study of replicating ideas is called "memetics," but before moving to a discussion of memetics, it is necessary to say more about the ideas of Spencer and Lamarck.

Spencerian Progress

The idea that there is some propulsive force or "law" of progress behind evolution seems to have arrived in the history of art and design as a result of the writings of Herbert Spencer. In a 1961 paper, Thomas Munro claimed that Spencer produced "the first detailed systematic attempt to fit the history of art into a naturalistic theory of evolution."[7] Increasing complexity, according to Spencer, was a change from the homogeneous to the heterogeneous, and from the indefinite to the definite. The development of the arts, he believed,

6 Germain Bazin, *A Concise History of Art* (London: Thames and Hudson, 1958), 522

7 Thomas Munro, "Do the Arts Evolve? Some Recent Conflicting Answers," *Journal of Aesthetics and Art Criticism* (Summer 1961): 407–417.

illustrated this tendency and thus exemplified the larger process of mental and social evolution.

Spencer wrote about this in 1857, two years before Darwin's *Origin.* The title of his 1857 essay was "Progress, its Law and Cause." He called the process of increasing complexity "progress," which then became "evolution." The evolutionary process took in everything from the stars to the arts. Later on, the process of social evolution came to be described as "cultural evolution."

After discussing notions of evolution in the history of art, Munro asks:

> ... if the term "evolution in art" is so ambiguous, so loaded with inconsistent meanings, is it usable at all in scholarly discussion? Would it be better to find another term, or a set of them?" [7]

My answer is "yes"; it would be much better if we stopped using evolution and used "Darwinian change" to signify descent with modification under the influence of natural selection. If some other kind of process is under discussion, then other terms exist. Spencerian change could be used for an inevitable process leading to greater complexity and improvement. Lamarckian change could signify a process whereby change results from striving for improvement, and the further transmission of such improvement.

Making a clear distinction between Spencerian notions of change and Darwinian change is essential if evolutionary accounts of design change are to be treated seriously. These days, most historians reject historical "forces" as a meaningful concept, and many are unhappy with notions of progress. Historicism (forces of history) and Whig history (things get better over time) both have been discarded. Since Spencer's ideas include both "forces" and "things getting better," it is not surprising that Spencerian notions of evolution have been rejected. However, Darwinian evolution depends on natural selection, which is a filter not a "force" and does not claim that change must be progressive (though it might seem to be on occasion). As long as historians confuse evolution with Spencerian change, evolution is going to be rejected, as it has been by Adrian Forty. The Darwinian alternative has not been given a chance.

Another reason for rejecting Spencerian notions of progress through increasing complexity is that they just do not fit the facts. Many writers before Darwin, including his own grandfather, Erasmus Darwin, had notions of a progressive gradual change. Lamarck was so keen on progressive complexity that when it was pointed out that there were some new, simpler organisms, he was forced to suggest that they must be the product of spontaneous generation.

Darwin's natural selection is different; it is *not* essentially progressive: it is more in accord with what we observe in nature where there are many examples of things becoming less complex.

The remote ancestors of the horse, for example, had five toes which became three and then one. At some stages in the complex history of horse species, there were species which became smaller while others became larger. There was no simple linear development from a small dog-like creature to the modern horse. It has taken time for this fact to be appreciated by non-biologists. The fault for this lies in museum exhibits such as those that used the evolution of the horse as a visual illustration of evolution, giving the impression of progress in a particular direction.

In 1959, the Natural History Museum in London was illustrating evolution with, among other things, the horse progression. This exhibit had four skeletons, the Hyracotherium or Eohippus, which was about the height of a fox terrier, the Miohippus, which was about two feet high (shoulder height), the Pliocene horse which, was about four feet high, and the modern Equus. The feet changed gradually from having toes in the Eohippus to having hoofs in the Equus. Similarly, the teeth seemed to change gradually.

A slight hint that things were not quite as simple as suggested by the gradual progression of the skeletons was given in the words of a booklet accompanying the exhibit which claimed that the early skeletons came from Europe, but the "genus Equus first appeared about a million years ago in North America, whence it spread rapidly to every continent except Australia." [8]

The complicated history of horse evolution was sorted out by George Gaylord Simpson, the American paleontologist who, in 1949, could claim, "The record has demonstrated that evolution is not some overall cosmic influence that has been changing all living things in a regular way throughout the periods of the earth's history." [9]

Spencer, of course, was a firm believer in "some overall cosmic influence" which propelled not just the evolution of life, but included the evolution of the stars and the arts as well. This belief just does not fit the record.

Stephen J. Gould has shown why people have been confused about the apparent movement towards complexity.[10] His argument is that, if you start with single cell creatures in a space of possibilities, then there is much more room in the direction of complexity than in the direction of less complexity. Nonetheless, viruses which are simpler than single-cell creatures are among the most successful creatures around today.

What Darwin actually wrote was that, if complexity exists, there is only one way that it could have arisen—through a series of gradual changes with selection at each step—"If it could be demonstrated that any complex organ existed which could not possibly have been formed by numerous successive, slight modifications, my theory would absolutely break down." [11] This is not the same as saying that things must become more complex. It is not the same as saying that all change must be gradual. And it doesn't even say

8 "A Handbook on Evolution, to Accompany an Exhibition" (The British Museum [Natural History] 1959, 2nd enlarged edition).

9 G. G. Simpson, *The Meaning of Evolution* (New Haven, CT: Yale University Press, 1949).

10 Stephen Jay Gould, *Life's Grandeur* (London: Jonathan Cape, 1996) (Published in USA by Harmony, New York as *Full House*).

11 Charles Darwin, *The Origin of Species by Means of Natural Selection* (London: J. Murray, 1859 [6th edition, p 137]), 58 and 402.

that things have to change. On the contrary, Darwin was aware that, given stable conditions of life, things could stay the same for long periods of time. In his own words, "A number of species... might remain for a long period unchanged, whilst within the same period, several of these species by migrating into new countries and coming into competition with foreign associates might become modified."[11]

It follows that Spencerian evolution differs from Darwinian evolution in two major ways: the former has both a force for change and a direction, the latter has neither—or at least it has nothing comparable to a law of gravity. In biology, Darwinian change does have trends, pressures, and so on, but mainly within a limited time span (remembering that a "limited" time in biology may be thousands of years). Similarly, some writers refer to trajectories of technological change, but these are not like trajectories in physics; they are unpredictable over a long time scale. Many of the changes in both biology and technology seem to be the result of accidents. But if we neglect the possibility of the existence of some patterns of change, we end up with the minimalist stance that everything that happens is contingent on circumstances that are never repeated.

As stated by Douglas Adams (the author of *Hitchhikers Guide to the Galaxy*):

> Anything that happens, happens,
> anything that in happening causes something else to happen,
> causes something else to happen,
> and anything that in happening causes itself to happen again, happens again.[12]

Natural selection lies somewhere between the extremes of a progressive force and the absence of anything other than "if it happens it happens." There is, however another alternative—Lamarckian evolution—which has a direction (progress), but replaces a "force" of nature by striving. It is obviously comforting to some people to believe that: (a) the world is getting better, and (b), that their own efforts play a small part in this process. Such people would be at home with a Lamarckian theory of evolutionary change in design.

The Lamarckian Alternative

We have now reached the point where we can return to Ozcan's interesting question—what would Charles Darwin have made of cars and kettles—or rather kettles and bicycles, since cars had not been invented. His first steps might have been to realize the importance of ideas, and to decide that ideas about artifacts can be called design. It is just possible that he also might have thought that changes in design were Lamarckian. Towards the end of his real life, Darwin came very close to accepting the Lamarckian idea of inheritance of acquired characteristics. If he had thought that changes in kettles and bicycles were Lamarckian, he would have been supported by several

12 D. N. Adams, *The Salmon of Doubt* (London: Macmillan, 2002), 29.

modern writers. For example, Nobel Prize-winning biologist Peter Medawar, discussed the "evolution" of tools or instruments which:

> undergo a slow systematic secular change of a kind which it is perfectly possible to describe as an "evolution" ... provided of course one realises that it is the design of these instruments that undergoes the evolutionary change and not the instruments themselves, except in a quite unnecessarily figurative sense.[13a]

Elsewhere, Medawar claimed that this kind of evolution is Lamarckian and not Darwinian because—"It embodies a learning process." [13b] Medawar was emotionally in favor of Lamarck because he wanted to believe that striving and learning achieved some permanent improvement.

Lamarckian ideas can be summarized as:

1 Striving to meet a need leads to greater use.
2 Greater use leads to improvement.
3 Improvements can be passed on—inheritance of acquired characteristics.

Lamarckian change is more than the inheritance of acquired characteristics, the muscles of the blacksmith being the classic case. On its own, the ingredient of acquired characteristics does not work. As Helena Cronin points out, why just the muscles, why not the bad back and the burnt hands, and what about the blacksmith's daughters? [14] The answer to why just the muscles being passed on is the ingredient of striving, and people who are in favor of striving tend to wish that Lamarck was right.

Another reason for liking Lamarckian ideas is that anything is better than leaving things to "blind chance." This reason was appealing to many people including H. G. Cannon who, as a Lamarckist Professor of Zoology at Manchester University, made life difficult for zoology students when I was a chemistry student there. In the preface to his book, Cannon states, "If I can make it understood that evolution represents a continuous succession of amazingly efficient things that work, and not an incredible series of successful 'treble chances,' then I shall feel that I have been justified, for this I am certain is the only way we shall escape from the arid conditions of modern genetical theory." [15]

The idea that Darwinian change is just "chance" is wrong, and the idea that biological change could be Lamarckian has been convincingly demolished by Richard Dawkins, who states, "Lamarckism is not just something that might be; it actually couldn't be... the theory is in principle incapable of explaining the evolution of serious adaptive complexity not just on this earth but anywhere in the universe." [16]

Dawkins points out that not all acquired characteristics are "improvements." The thing that separates changes that are improve-

13a. P. B. and J. S. Medawar, *The Life Science,* Chapter 6 (London: Wildwood House, 1977), 52.

13b P. B. and J. S. Medawar, *Aristotle to Zoos: A Philosophical Dictionary of Biology* (Cambridge: Harvard University Press, 1983), 97. See also P. B. Medawar, "Technology and Evolution" (The Frank Nelson Doubleday Lectures, New York, 1973).

14 Helena Cronin, *The Ant and the Peacock: Altruism and Sexual Selection from Darwin to Today* (Cambridge: Cambridge University Press, 1991).

15 H. G. Cannon, *The Evolution of Living Things* (Mancester: Manchester University Press 1958), ix.

16 Richard Dawkins, *The Blind Watchmaker* (London: Longmans, 1986), 288.

ments from those that are not is a selective environment. (We have to remember that "environment" is not just the weather and stuff that "Greens" worry about. For a particular gene, all the other genes are part of its environment. It has to FIT—to Function In Time and Fit In Too.)

Discussing behavior, Dawkins said, "Suppose the skills acquired during life by animals could be translated into DNA and get passed on. They would be one jump ahead, and evolution would be speeded up." However, "This all presupposes that the changes in behaviour that we call learning are, indeed, improvements. Why should they necessarily be improvements?... there must be a Darwinian underpinning to ensure that acquired characteristics are advantageous." [16]

In other words, while evolution might happen somewhere in the universe in a manner which involves striving and the inheritance of acquired characteristics, such a system would not exhibit adaptation; it would not exhibit the appearance of design. The main reason for this is that there is no way of knowing what to strive for.

Striving has to be seen as a necessary but insufficient factor in Darwinian change. Any animal that inherited a lazy disposition would have reduced chances of passing on such a disposition (the human animal being an exception, of course). Animals have to spend their lives striving to keep up with the demands of the four Fs—feeding, fighting, fleeing, and the other F (in my view, the four Fs of the limbic nervous system need the addition of a fifth—fun). This is just a base line; they need a competitive edge if they are going to survive and replicate. The nature of the competitive edge is selected (not caused) by the animals' surroundings including other animals, sources of energy, and sources of danger.

So it is with human design. Ideas compete for resources, first within the head of an individual designer, then within an organization, and then in the selective world of purchasers and users. But surely human design is different: humans can imagine something that does not exist and organize resources to make it exist. This is the nature of striving, and Dawkins's objection to Lamarck in biology also applies to human design. The problem is that the best designer in the world has no way of knowing what the future will bring. Assumptions about what would make an improvement are notorious for coming up against unanticipated obstacles.

Changes in the environment can lead to the results of striving becoming redundant. What happened to the large muscles of the blacksmith when no one wanted blacksmiths anymore? Once, a faster airplane could be assumed to constitute an improvement. Then came the Concord, made possible only by massive expenditures by the French and UK governments. Similarly, the designers and engineers who developed the Hovercraft thought they were striving for an improved form of transport, aimed initially at the need for a transport system that could cover both land and water. However,

the helicopter filled that niche and the secondary aim of a "better" way of traveling over water was defeated by other advances in water transport such as the hydrofoil.

Six different firms who tried to make and sell the Hovercraft all had to give up the attempt. Even though all the costs of developing a working Hovercraft were paid for by the British Government, it was not possible to make a profit from the manufacture and sale of something that people did not want.[17]

In other words, the Lamarckian alternative which sounds like a description of human design—things getting better through the striving of individuals—in fact does not work. If we wish to discuss design evolution, we have to consider Darwinian natural selection.

Natural Selection Outside Biology

Although he did not specifically mention kettles and bicycles, we do not have to do much guessing to have a good idea what Darwin thought about change in non-biological systems. In his second great book, *The Descent of Man and Selection in Relation to Sex,* he speculated about the application of natural selection in areas outside of biology. For example, on language he stated, "The survival or preservation of certain favoured words in the struggle for existence is natural selection." Darwin quoted a writer in *Nature* in 1870 who wrote, "A struggle for life is constantly going on amongst the words and grammatical forms in each language. The better, the shorter, the easier forms are constantly gaining the upper hand, and they owe their success to their own inherent virtue." As Darwin pointed out, there is more to "success" than "inherent virtue"; language does not necessarily progress in the direction of being more virtuous. He suggested, "Mere novelty and fashion may be added for there is in the mind of man a strong love for slight changes in all things." [18]

Darwin was well aware of the importance of mind. He suggested that a sophisticated language requires a sophisticated mind, and the only way that could have happened was by what he called "correlation of parts," a term to describe how two different things changed slowly together so that they could keep in step. He had similar views on technical change or invention:

> If some one man in a tribe, more sagacious than the others, invented a new snare or weapon, or other means of attack or defense, the plainest self interest without the assistance of much reasoning power, would prompt the other members to imitate him and all would thus profit. The habitual practice of each new art must likewise in some slight degree strengthen the intellect.[18]

At first sight, the nature of the selection system within which ideas compete might be seen as being very different from the selection system in biology, but Darwin had two important theories which are relevant here. The first of these is unconscious selection. Because we

17 P. S. Johnson. "The Development of Hovercraft," *Three Banks Review* (December 1974).

18 Charles Darwin, *The Descent of Man and Selection in Relation to Sex* (London: John Murray, 1871 [2nd Edition, 1883]), 129 and 91.

have some control over the selection system, it might be thought that the evolution of kettles and bicycles was a form of artificial selection, like animals being bred by humans. However, Darwin was aware that even artificial selection did not proceed in a totally rational fashion. He gives the example of two flocks which started out as divisions of the same flock of Leicester sheep but, over fifty years, diverged from each other in an unpredictable manner to such an extent that they had "the appearance of being quite different varieties." He called this phenomenon "unconscious selection."[19]

Governments like to think that they make quite conscious decisions to support some things and discourage others, which of course they do but such decisions may have "unconscious" effects. The "rules" of the competition between design ideas can be altered deliberately by taxing some things and subsidizing others. Some things can be made illegal, while awards may be given for other kinds of things. The problem is that there is still the need for what Dawkins calls "a Darwinian underpinning" because governments do not really know what to support and what to discourage, and because of the unexpected effects of "unconscious selection." The British government has supported Hovercraft and hydrogen bombs. It supported larger families by offering child benefits. It has banned cannabis and working for the government after age sixty-five (apart from judges and prime ministers). When the contraceptive pill was introduced in the UK, medical treatment was free under the National Health Service, but prescriptions for the pill had to be paid for. Today, there is a charge for most prescriptions, but the pill is one of the exceptions; it is free.

As a society, we can use reason to attempt to make improvements, but there always is uncertainty about outcomes so we still are left with a Darwinian natural selection system underpinning our efforts. A good example of this can be found in England, where a government-funded cull of badgers was carried out to reduce the incidence of tuberculosis in cows that can catch TB from infected badgers. Badgers are social animals that live in small groups and do not travel very much as long as they have food and company. Attempting to kill the badgers destroyed the groups and left lone badgers roaming the countryside. This apparently led to a twenty-seven percent increase in bovine TB in areas where badgers had been shot, compared to control areas where no shooting had been allowed.[20]

Even when we are very sure that some change would be for the better, such change will still have the unexpected side effects of Darwin's unconscious selection.

Darwin called the second of his theories that concern the selection system "sexual selection":

> The nests of humming birds and the playing passages of bower birds are tastefully ornamented with gaily colored objects; and this shows that they must receive some kind of pleasure from the sight of such things.[21]

19 Charles Darwin, *The Origin of Species by Means of Natural Selection,*(1859), 25.

20 "Badger Killing Led to Rise in TB," *The Guardian,* (November 5, 2003): 9.

21 Charles Darwin, *The Descent of Man and Selection in Relation to Sex* (1883), 92.

Darwin saw the main role of pleasing sights and sounds to be sexual attraction, and he was fascinated by the peacock's tail. Clearly, a tail which is large and heavy has no advantage in survival terms—it requires energy and it advertises its presence to any passing predator. Darwin's explanation was that basically the female peacocks had a preference for elaborate tails, and the evidence for this was that the peacock tails are at their peak during the mating season.

He called this phenomenon, "sexual selection." Another example was the Argus pheasant. Referring to the Argus pheasant, Darwin stated:

> He who thinks that the male was created as he now exists must admit that the great plumes, which prevent the wings from being used for flight and which are displayed during courtship and at no other time in a manner quite peculiar to this one species, were given to him as an ornament. If so, he must likewise admit that the female was created and endowed with the capacity of appreciating such ornaments. I differ only in the conviction that the male Argus pheasant acquired his beauty gradually, through the preference of the females during many generations.[22]

So I am sure that Darwin would have been happy to see kettles and bicycles in terms of the evolution of ideas, and that he would not have seen such a process as being particularly progressive. He would have found room for fashion, "a strong love for slight changes" and "unconscious" design. He would have drawn an analogy with sexual selection, and he also would have been happy with the notion of imitation as one way in which ideas are spread under the influence of "the plainest self interest without the assistance of much reasoning power."

So far I have tried to establish (1) that ideas of evolution that exist in the design literature are confused or pre-Darwinian and, should be consigned to the waste basket; (2) they should be replaced by a nonprogressive Darwinism; and (3) that the form of Darwinism that is needed to make sense of change in design is the evolution of ideas.

In the 1930s, biology achieved a synthesis of the ideas of Darwin with the ideas of genetics and the mutation of genes to produce neo-Darwinism. Genes provided an answer to the problem of replication. Mutation provided an answer to the problem of the source of new varieties without which natural selection comes to a halt.

A neo-Darwinian view of design change is natural selection plus memes, their competition, their modes of transfer, and their transformation; i.e., memetics.

22 Ibid., 616.

Towards the Memetics of Design

Dawkins's memes which, in this context, are design ideas that can be replicated do not have to wait very long for replication to take place. They speed up the old genetic form of Darwinian change, but the evolution of design ideas is still Darwinian because ideas about what to strive for are in competition for scarce resources to turn them into manufactured realities. There are no basic principles telling us how one group of designed objects is superseded by another. The process essentially is unpredictable. There is no law of selection "to propel things in the direction of progress." Selection is blind because there is no way of knowing what happens next. Nonetheless, we keep trying. If we stop striving for improvement, we have stopped being human, but we should not be surprised if our efforts sometimes fail. Once this apparently gloomy view is absorbed, it can be put to work.

What might be called "Darwinian design under the influence of natural selection" was first used to make money by the German dyestuffs industry in the nineteenth century. Teams of skilled synthetic organic chemists were employed to make novel, colored chemical compounds. Since there was no way of knowing which of these would make useful dyes, the new compounds were tested in a dye house where most were found to be useless, but some were selected for further chemical modification in the hope of improving them. By 1910, it was calculated that ten thousand new compounds had to be tested to find one new commercial dye, but the profits from the one, successful dye were much greater than the cost of producing the ten thousand.

I find it reasonable to call such a process Darwinian, but Darwinian processes can have very surprising side effects. The demands of the German chemical industry for university trained organic synthesizers to make the new compounds led to the invention of a "junior doctorate"—the Ph.D.—which would take less time to achieve than the traditional higher doctorate, the D.Sc. The Ph.D. spread from Germany to the U.S., and then around the world so that today's potential academics in any subject have to obtain an academic qualification which was invented for the German chemical industry. I do not detect any sign of progress in this particular step in the evolution of education. The "meme" of a Ph.D. has been remarkably successful in propagating itself and, like the peacock's tail, it has prospered because it is "fancied" and not because it is "better."

However, there is a danger in replacing Spencer or Lamarck by memetics, and that is the replacing of one confused way of thinking with another. The achievements of memetics so far have not been impressive. Elsewhere, I have argued that, if memetics is to develop, it needs to do three things. The first is to move away from its concentration on imitation and epidemiology. The second is to realize that thinking of memes as "units" is not helpful. They are "patterns."

The third is to recognize that there are different types of memes with different methods of transmission. These are "recipemes," "selectemes," and "explanemes."[23]

Recipemes are transmittable ideas about how to do things—recipe ideas.

Selectemes are ideas about what sort of thing you want to do. They are involved in making decisions between alternatives. They provide motivation; they are values.

Any designer working for a client has a set of ideas about what the client wants. They also have ideas about the marketplace, about fashion, and about the sorts of designs that their peers approve of. These ideas are not worked out like a physics equation. They form a "pattern" in the mind, what Maria Abu-Risha calls a "pattern of need." I think that this is a pattern of selectemes.

At the same time, designers have other groups of ideas of things that are possible, ideas about how to make things—recipemes. These form a pattern of possibilities which are compared with the pattern of need until there is a "click"—a fit between the selectemes and the recipemes. Maria Abu-Risha calls this click "purposive pattern recognition" (PPR).[24] It is purposive because the designer knows what to do next.

The same concepts of selectemes and recipemes can be used when thinking about how design changes over long time periods. They are not restricted to an account of the here and now of a specific act of designing. In the same way, genes are used to describe what happens at the conception of an individual life, and they also are used to discuss how things change over millions of years. Both genes and memes are evolutionary replicators.

The third type of meme, the "explaneme," must be added because of the human propensity to ask "why?" As long as humans have had a language, they have told stories, and good stories get replicated. If someone discovers a new recipe, people will ask why it works as well as how it works. Explanemes are ideas that provide the basis for answering "why" questions. They range in sophistication from simple stories to complex mathematical concepts, but they have two things in common, they offer an explanation and they need a language to be transmitted. They differ in this from the other memes which sometimes can be transmitted by imitation without formal language.

Explanemes form an essential part of the discussion about Darwinian design change because of the claim that human rationality, science, and mathematical engineering makes modern design change different from the days of craft design when people did not know what they were doing (they still had stories though). An essential part of the claim that design change is Darwinian (and not Lamarckian) is the Dawkins "knockout" that all that rationality counts for little if we do not know what is going to be "better." In fact, our ideas of improvement are themselves subject to Darwinian

23 J. Langrish, "Different Types of Memes: Recipemes, Selectemes, and Explanemes," *Journal of Memetics* 3 (1999). (www.cpm.mmu.ac.uk/jom-emit/1999/vol3/langrish_jz.html)

24 Maria Abu-Risha, "Purposive Pattern Recognition," (Ph.D. thesis, De Montfort University, 1999).

change. Selectemes are in competition with other selectemes and, at different times and in different places, some are more successful at being replicated than others.

Returning to Forty

As stated above, Forty rejects both "great men" and evolution as explanations for changes in design. So what does he put in their place? The short answer is "ideas"—but what sort of ideas? Near the start of his book, he claims:

> Every product to be successful, must incorporate the ideas that will make it marketable, and the particular task of design is to bring about the conjunction between such ideas and the available means of production.[25]

Forty, of course, is aware that "the available means of production" are themselves designed and subject to change, but he does not like the idea that technological change "causes" design change. He calls this "the mechanical fallacy."[26]

As an example, Forty shows how the mechanization of sewing in the United States and in Victorian England was followed by a fashion for heavily trimmed dresses (i.e., lots of elaborate extra material sewn on to the basic dress). This additional sewing was achieved at little or no extra cost to the purchaser of the dress because the sewing machine could sew much more cheaply than had previously been the case.

Forty resists the conclusion that the sewing machine "caused" the fashion change by pointing out that sewing machines could have been used to reduce the hours worked by the machine operator or to pay the workers more. He concludes:

> Thus the ultimate cause of the fashion for heavily trimmed dresses was not now the sewing machine itself, but its use within a capitalist system of manufacture.[26]

Now, the concept of an "ultimate cause" is another idea from older theories of change. Darwinian change has few, if any, events that might be labeled "ultimate."

In a Darwinian system, the recipemes (e.g., sewing machine technology) have to FIT into an environment of selectemes which includes ideas of desirability held by those who put up the money for the technology, as well as ideas of desirability held by those who buy the products of the technology.

Forty and I, however, do agree on one thing, and that is the importance of changing ideas. To me, the history of design is the history of ideas—ideas about how to make things which I like to call recipemes, and ideas about what sort of things to make which I like to call selectemes. People make choices between competing ideas, and they sometimes use another kind of idea to justify their choice. Such explanatory justifications are my explanemes. All these

25 Adrian Forty, *Objects of Desire: Design and Society Since 1750*, 9.

26 Ibid., 51.

ideas and their interactions can be said to evolve. These ideas are the memes of design, and I would hope that a modern Darwin would agree that their evolution is a Darwinian process, involving competition for resources to ensure their survival but lacking long-term predictability for two reasons: first, the "rules" of the competition keep changing and, secondly, success in being replicated is subject to chance and whimsy. Spencerian progress is nowhere to be seen, and should be consigned to the waste basket of rejected explanemes.