
An Evolutionary Explanation Model on the Transformation of Culture by Cultural Genes*

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ABSTRACT

This article seeks to explain how cultural transformation takes place through the evolution of cultural genes. This explanation posits that just as the evolution of an organism takes place at the genetic level, so also does the transformation of culture. As such, this paper must answer the four following questions:

1) Are there cultural genes that correspond to biological genes? 2) How can we prove that the fundamental characteristic of such cultural genes is to replicate themselves? 3) Will the recent intensified fusion of civilization lead to more variations of cultural genes? 4) What relationship is there between biological and cultural genes?

A NEW GENE: THE CULTURAL GENE

The greatest distinction of culture is that it is propagated from individual to individual not through biological genes, but rather through social learning. Cultures may be defined as systems of information which are objects of learning. 'Culture is information capable of affecting individuals' phenotypes which they acquire from other conspecifics by teaching or imitation' (Shennan 2002: 37). As a means of explaining the evolution of culture, Richard Dawkins coined the term 'meme', an abbreviation of the Greek word for an imitation, 'mimēma', to denote a unit of transmitted cultural content that operates as a replication of cultural information (Dawkins 1976: 192). Susan Blackmore has also greatly expanded the theory

of the meme, showing memes to be working in parallel with genes. We can distinguish memes and genes from each other in the following way: genes are the bits of information stored within a body's cells that create proteins transmitted to the next generation, whereas memes are bits of information stored within the brain or elsewhere, transmitted through replication, for the sake of bringing about the accomplishment of certain actions. Both, however, can be described as the original form of information.

The continuation and prosperity of life was made possible first and foremost with the emergence of genes replicating themselves. Genes were formed within the primeval soup, and as they floated around, commenced copying their own being. They then mutually combined and separated, creating various genetic shapes, with the result being the appearance of a variety of life forms. It can be said that cultural genes, the most basic unit of cultural formation, were the same as these biological genes. Cultural genes were also floating around the primeval cultural soup, attempting to replicate themselves. 'Just as genes propagate themselves in the gene pool by leaping from body to body via sperms or eggs, so memes propagate themselves in the meme pool by leaping from brain to brain via a process which, in the broad sense, can be called imitation' (Dawkins 1976: 192).

It can be said that ideas such as Karl Popper's 'world of ideas in the objective sense' (1979: 153) or Georg Hegel's 'Die Welt der objektivierter Geist' (Hegel 1970: 324) all mean the great ocean we call 'culture'. The core inhabitants of those simultaneously living within this world of objective sense, namely, theories, propositions, or statements, are thus important cultural genes. Those things that must be included within Hegel's world of objectified spirit, literature, poetry, plastic arts, music and all the creative arts, every type of monument, building, artwork, tool, weapon, handicraft and industrial product, all scientific and philosophical systems, all mythical ideas, or religious concepts, all of these are important cultural genes.

Biological and cultural genes are certainly not identical on all fronts. In their means of existence and propagation, they differ. However, it can be said that they both: 1) are the original forms of information; 2) possess the means by which the variations in these original forms can be produced; 3) are susceptible to the process

of natural selection; and 4) in terms of the propagation and reproduction of the selected variations, transform in an evolutionary manner. This idea can be seen in the following:

Original Information	Variation	Choice	Copy
a	a		a1
	a1	a1	a1
	a2		a1

If we define culture by cultural gene, to say that culture evolves is the same as to say that cultural genes transform in the evolutionary manner. Admittedly, it is possible to agree that the world of objectified spirits or the world of the ideas in the objective sense evolves, but it is too holistic. If the world does not change at once, we have to discuss a change of the part of the world in a certain way. That is, when we can specify the basic constituents of the culture which we can call cultural genes and discuss the evolution of them, the evolutionary explanation of culture has a concrete meaning. That is the same logic as the case when evolution in biology is explained on the level of the biological genes.

How could it be possible for cultural genes to copy and vary themselves? They appear as the copies of the famous brand, and also as mutations, when the different cultures meet one another. The fittest among cultural genes are thus adapted such as the fittest among biological genes are adapted. Some ideas fade away at once. They are transferred from generation to generation, becoming more sophisticated and undergoing transformation. Cultural genes spread from here to there through learning and mimēsis. For example, Plato's Theory of Ideas was transferred to me, when I learned it, and when the students whom I teach in the classroom understand that theory, it is then transferred to them. Similarly, you learn traditional manners and etiquette from your parents at home and new fashion ideas and knowledge from mass media. When you dress like a TV star or imitate his/her gesture, such style or gesture is transmitted to you, and it would also apply to everyone else who does the same.

From a substantial point of view, it can be said that this transmission leads to the self-replication of a cultural element, or a cultural gene. Plato's Theory of Forms, given as an example above, would have replicated itself as many times as the number of people who understood the theory. Likewise, the gesture or style of dress would have replicated itself as many times as the number of its imitators. In this sense of self-replication, cultural genes are similar to biological genes.

Like biological genes, all cultural genes cannot have the same ability to self-replicate. They are different in fecundity as well as longevity. Some may go on just like a passing fad, but others can survive for thousands of years like the Confucian virtues of humanity, justice, etiquette and wisdom, by continuing to replicate themselves.

Cultural genes can be divided into two types: genotype and phenotype. The former is the spiritual representation of cultural genes, while the latter refers to their embodiment, that is, a form that appears when they are expressed or transmitted. There may be cultural genes which have the same genotype but are different in phenotype. Beethoven's 'Moonlight' Sonata can be played in different ways according to each musician who plays it. It is similar to the fact that, even though pine trees in the Arctic are genetically the same as pine trees in temperate zones, their height and shape are significantly different on account of differing climatic conditions.

The difference between cultural transmission and genetic transmission can be discussed from a different perspective. In the world of biological genes, offspring have their own parents, while there exist no such cultural parents in the world of cultural genes. Even if you could use the terms 'cultural parents' and 'cultural offspring', they are never linked to each other, which is quite unlike biological generations.

The length of a cultural generation varies according to the situation. In a fast-changing society, cultural generations are much shorter than biological generations, while in a slowly changing society, cultural generations are more likely to remain very long. Biological and cultural genes are completely different even in their method of transmission. Biological genes only have a pathway through which they are vertically transmitted from parents, but cultural genes can be hori-

zontally transmitted among people unknown to one another, from a single person to many other different people or from a large number of people to an individual (Shennan 2002: 50).

In most cases, cultural genes seem to enjoy greater longevity than biological genes. When the cultural genes appear in the clothes of language, they go beyond the restrictions of time to some degree and exist independently unlike biological genes, which are only present in living creatures. When one says the genes are immortal coils, it means that they continue to survive many generations in those living creatures. In contrast, the cultural genes can remain independent in the clothes of language, but not in living things. Provided that a printed book is stored well, it can hold good for hundreds of years. If the book were never read by anyone, the replication of cultural genes would remain suspended, or in a sleeping state. However, the sleeping state does not mean that they have become extinct. They can return to the active state any time. For example, the Greek and Roman 'Geist' had been asleep for a thousand years until the early 14th century in which it was rediscovered by the Renaissance. As a result, the Renaissance woke up sleeping cultural genes and reintroduced them into the mind. In other words, the cultural genes constituting the Greek and Roman spirit were awakened from sleep to start self-replication again.

Cultural genes reproduce themselves very quickly, while biological genes propagate themselves over many generations. Cultural genes can be spread in an instant. The same goes for biological genes, but more important to them is fecundity rather than longevity. The degree of reproduction is referred to as fitness. For biological genes, the fitness is calculated according to how many offspring are produced, but for a scientific theory it is measured according to how many scientists accept the theory, and for a song, the fitness is calculated according to how many people like to sing it.

Despite those differences, both biological and cultural genes are units of information and may be subject to evolutionary explanation in that they both have the mechanisms of variation, selection and replication.

CHARACTERISTICS OF CULTURAL GENES

So far we have discussed two kinds of genes. One is biological, the other is cultural. Both are self-replicating agents. Blackmore's (1999)

study of the issues is remarkable for the following reason. She asks about the first issue as follows: 'Is Beethoven's Fifth Symphony a single cultural gene, or do its first four notes constitute a cultural gene?' That is the type of question that must be answered when we try to define the 'units' of cultural genes. However, even if the unit of cultural genes is clearly defined, there still may be a doubt about what constitutes the unit if transformation takes place in the process of transmission. For example, even if you have understood Immanuel Kant's Copernican Revolution, you may not accept it as Kant intended, so what you understand may be a little different from what he meant. You may develop your own interpretation in some way, but on the other hand you may have a completely false understanding of it. This can be repeated in the process of transmitting an idea to others. You can transform the idea deliberately to create a similar but different idea or combine it with another idea to come up with a third idea. With all these possibilities, could it still be said that there exist independent cultural genes?

In fact, it is hard to split a group of cultural genes into separate units like bricks in a brick wall. The same seems to apply to biological genes. In the world of biological genes, some genes have independent forms and some exist in groups. Some others are newly generated genes. A mixed race couple is likely to have offspring with a skin color between their own. All this being so, it is still not impossible to set the unit of genes. Dawkins defines the gene as follows. 'The "gene" was defined, not in a rigid all-or-nothing way, but as a unit of convenience, a length of chromosome with just sufficient copying-fidelity to serve as a viable unit of natural selection' (Dawkins 1976: 195).

For instance, let us suppose that the Copernican theory is divided into two parts, A and B. If one person accepts A but rejects B and if another person accepts B but rejects A, these two parts can be regarded as different cultural genes. However, if those who accept A always accept B as well (that is, if A and B are closely related to each other), then they can be considered to constitute a single cultural gene.

Furthermore, even if your understanding of Kant's Copernican Revolution is a little wrong or incorrect, there is no doubt that the idea is present in the form of a single cultural gene. The reason is that, if this is denied, it would be impossible for two people to

reach a consensus on a certain idea and it is nonsense to create a new version of nothing.

Dennett's intentional systems theory does an excellent job of explaining the reason why we look at self-replication as the most predominant characteristics of a cultural gene.

Intentional systems theory is in the first place an analysis of the meanings of such everyday 'mentalistic' terms as 'believe', 'desire', 'expect', 'decide', and 'intend', the terms of 'folk psychology' that we use to interpret, explain, and predict the behavior of other human beings, animals, some artifacts such as robots and computers, and indeed ourselves (Dennett 1971).

According to Dennett, because these objects are inevitably possessed of faith and desire, they are not being explained through the use of such terms. If these objects are approached via the intentional stance, and if as a result we are more capable of explaining and predicting actions, then we are capable of adopting those positions. This can become a most potent methodological strategy. This is due to the fact that while intention is an attribute that is only able to be ascribed to beings that are naturally endowed with consciousness, within the methodological realm, it becomes possible to ascribe this type of attribute even to unconscious beings.

Dennett classified the stance of human beings with respect to an object in three ways: intentional stance, physical stance and design stance. The physical stance is to explain inanimate objects and artifacts based on the laws and principles of physics. For example, the laws of physics govern the motion of a falling stone. Stances other than the physical stance are not required to explain the fall of a stone. The design stance is a strategy taken by one who supposes that a certain object is designed to behave in a certain way and that it will work in parallel with the design. From the design stance, we can predict the behavior of a clock when we try to explain how it works. The intentional stance is a strategy that assumes a certain object behaves like a rational agent.

Dennett's three stances have been criticized as being instrumental strategies. However, determining whether they are instrumental or realistic is not essential to the present discussion. To return to the main point: the question is whether the intentional stance is the best method of explanation or not.

We do not act solely in accordance with our own views or perspectives; we exert effort to disseminate the ideas we believe in the widest extent and such that we can win the sympathies of the maximum number of people. In addition, we also voluntarily aim to imitate the thoughts and actions of those people we believe to be successful and influential. If this is seen in terms of cultural genes, this is saying that we exert the maximum effort for the replication of ourselves. The fact that genes are endowed with this attribute of self-interested replication is rooted within this biological phenomenon that concentrates the maximum effort towards our own survival and the propagation of descendants. The greatest beneficiary of this phenomenon is that which we call the gene.

According to Dawkins, replicators have three basic properties: copying fidelity, fecundity and sufficient longevity (cf. Dawkins 1976: ch. 2) and there are no significant differences between biological genes and cultural genes in those properties. To be successful, a replicator should, so to speak, have high fidelity, be able to create many replicas and have sufficient longevity so that it can influence its own replication rate (Shennan 2002: 47).

From a more comprehensive point of view, I think that all the properties Karl Popper ascribed to World 3 can be also applied to cultural genes as they are, because World 3 is a reservoir of cultural genes. The properties of World 3 include reality, autonomy, timelessness and intersubjectivity (Gilroy 1985: 189). It can be said, therefore, that cultural genes also have the properties of reality, autonomy, timelessness and intersubjectivity.

The autonomy of World 3 can be explained as follows (Popper 1982: 118ff.): Natural numbers are created, but prime numbers and odd or even numbers are discovered. To be specific, we create a series of natural numbers fixed by repeating the act of adding the basic unit '1' to every successive compound unit that we generate, and the series of natural numbers comes to have autonomous properties such as prime numbers, odd numbers and even numbers, though they have never been considered in the spirit that creates them. Therefore, we cannot say otherwise than such properties are not created but discovered.

World 3 objects are beyond time as we cannot attribute temporal predicates to them. As a matter of course, there exists the time when they are created, and World 3 can be said to suffer increase

as a whole. Once they are created, however, individual entities of World 3 should exist eternally like Plato's Forms.

Intersubjectivity entails that World 3 objects can be understood by the human spirit, but are different from the human spirit that creates them. A particularly important consideration is that intersubjectivity is a dispositional characteristic possessed by the objects of World 3 regardless of whether it is actually realizable. 'Thus I do admit that in order to belong to the third world of objective knowledge, a book should – in principle, or virtually – be capable of being grasped (or deciphered, or understood, or "known") by somebody' (Popper 1979: 116; Klemke 1979: 47).

The third issue, that of the relationship between biological genes and cultural genes, is also a difficult problem to solve. From a socio-biological perspective, cultural genes are an extension of biological genes. This is like saying that cultural genes come from biological genes. However, it may be true in reverse as well. This is supported by the argument that cultural genes can evolve autonomously independent of biological genes and have more powerful effects than them. 'Of course, the memes do not care; they are selfish like genes and will simply spread if they can' (Blackmore 1999: 7).

ARTIFICIAL VARIATIONS OF CULTURAL GENES

Globalization is an undeniable reality of our age. Globalization means that the world we live in is becoming a single global village without physical boundaries, where we are no longer confined within the enclosed space of nation-states but rather mingle freely in a single open space shared by all. The problems and events that face us are also increasingly becoming independent of the bonds of nation, state, and citizenry. Cultures are no exception to this trend: amidst the active mingling of cultures, it is becoming more and more difficult for individual nations to retain their cultural traditions.

From a broad perspective of world history, the most noticeable aspect of globalization is the continuous contact and exchange between civilizations. This is not to say that there has been no contact between civilizations in the past. Such contact, however, was fleeting in duration and of limited scope between neighboring civilizations. In the age of globalization, this contact takes the form of

an unavoidable, simultaneous collision of all aspects of all civilizations. As a result, culture shocks of great magnitude may occur in many aspects. Samuel P. Huntington emphasizes this resultant 'clash' in the contact between civilizations (Huntington 1996). For example, under this logic the current Middle Eastern crisis would be attributed to the clash between the Christian civilization and the Islamic civilization. On the other hand, Harald Mueller asserts and argues for the possibility of coexistence in the meeting of cultures (Mueller 1998).

Whether clash or coexistence, these theories are based upon the idea of civilizational pluralism, which states that all civilizations develop with a unique identity. The assertion of civilizational pluralism is as follows. 1) A civilization has own peculiar world view and this view is impossible to reduce to a common denominator. 2) The history of mankind is not a universal history, but rather a simple sum total of all the histories of all civilizations.

However, an information revolution that we face makes the civilizational pluralism impossible. Fusion of civilizations is inevitable, because virtual space makes us feel as if we are living in one city. Today, it is difficult to argue for the uniqueness of civilizations. The theory that civilizations cannot be reduced to a common denominator has become an empty and unrealistic. The theory of the paradigm of civilizations is false, along with theories of scientific paradigms.

Diversity of individuals is a necessary condition for natural selection of adaptive variations, resulting in survival and reproduction of the fittest. The great value of variation is indicated by the prevalence of sexual reproduction, which imposes difficulties but has the advantage of combining different genes from the male and female parent. Cultural evolution also needs diversity as a basis for selection (Grinin, Markov, and Korotayev 2009: 201). The recent fusion of civilizations will probably accelerate cultural evolution.

I think that the fusion of civilizations can be explained by the evolutionary mechanism of cultural genes. The artificial variation of cultural genes is characteristic of evolution of civilizations. Biological genes and cultural genes are not always the same in every aspect. While biological genes are combined in a single cluster, cultural genes do not remain like that. Rather, our brains act to bind them together. So to speak, biological and cultural genes differ in

the way they exist. Biological genes are naturally generated, but cultural genes appear as the results of conscious efforts. For this reason, S. J. Gould (1996) and H. Rolston (1999) *et al.* object strongly to the application of biological evolution to cultural evolution, arguing that it is undesirable to compare them to each other.

Even though the genetic processes are under constraints on the space to be searched, and though ‘smart’ genes use randomness to generate clever problem-solving algorithms the genetic process is nondeliberate, random, or ‘blind’ (no conscious envisioning of the future). There’s ‘nobody there’ thinking about it. By contrast the brain-based scientific process is consciously rational and deliberate. Natural selection is radically transcended because scientists ‘know what they are doing’, whereas the genes do not – not at least in this intentional sense (Rolston 1999: 172).

I believe that Gould is right. There is a difference between evolution of biological gene and cultural gene. But they are all under the universal evolutionism (Carneiro 2005: 136). The evolutionary mechanism of biological gene is as follows:

natural variation + natural selection → new species

The evolutionary mechanism of cultural gene is transformed as follows:

artificial variation + natural selection → new civilization

Artificiality, instead of nature, is characteristic of evolution of civilization. The evolution of civilization requires artificial variations of cultural gene. The variations of cultural genes result from conscious act. New civilization therefore can be created only by the human efforts.

REDUCTIONISTIC AND NON-REDUCTIONISTIC EXPLANATIONS

E. Sober proposed three evolutionary explanation models. According to Sober, evolution requires two critical elements. One is a characteristic difference that helps distinguish between the abilities of objects to survive and propagate. The other is a method that ensures offspring resemble their parents. In general we call the former ‘differential fitness’ and the latter a ‘transmission pathway’

(Sober 1993: 210). There are three explanatory models based on the concepts of 'transmission pathway' and 'fitness'.

	heritability	fitness
I	genes	having babies
II	learning	having babies
III	learning	having students

Now let us apply the concepts to a cultural phenomenon. The first evolutionary model explains that if a cultural characteristic has become predominant, it is because the gene that expresses the characteristic has been selected.

The second model recognizes that a living creature seeks to maximize its fitness but argues that cultural characteristics are transmitted by learning, not genes. For instance, if the reason for resemblance between offspring and their parents were that they try to imitate their parents, selection would take place without the intervention of genes. The incest taboo is a good example of evolution controlled by learning instead of genes.

The third evolutionary model maintains that cultural characteristics are transmitted not only between parents and their offspring but also by learning among people who are biologically unrelated. The fitness is measured according to how many followers an organism has, not the number of its offspring. Individuals have their own thoughts because they are exposed to the thoughts of their parents, their friends, and others. The direction of transmission may be vertical, horizontal, or diagonal. Thoughts spread like an epidemic, and while some of them decline away, others prevail.

We do not need to distinguish between the second and the third of the three models. This is because every transmission pathway is learning and offspring can be seen as followers. Further, in Sober's explanation models, cultural genes are not centrally positioned.

In regard to cultural phenomena, I want to expand further this argument and divide the evolutionary explanatory model into two categories of reductionist and non-reductionist lines. Reductionist explanations may recognize cultural genes. However, these explanations understand the function of such genes only as something that raises a biological gene's level of adaptation. To the contrary, non-reductionist explanations understand cultural genes in terms of raising their own level of adaptation, entirely independent of the adaptability of biological genes.

The most simple reductionist explanation is that cultural genes must ultimately be reduced to biological genes. That is to say, the common presence of some cultural characteristic in society can be explained due to the common selection of biological genes that made the actualization of that cultural characteristic possible. While it may appear on the surface that biological genes have no connection with some behavior or cultural characteristic in reality, there is no way for such phenomena to appear outside of the functioning of a biological gene. Seen from this perspective, the process of cultural evolution and the true power that develops culture are, in fact, more so than this thing we call 'culture', namely, the evolution of biological genes.

The representative school of this sort of reductionist explanation is the discipline of traditional social biology. This discipline asserts the following as taking place within the relationship with biological genes: humanity's true character is encoded with the structure of the gene, and as such, the contents of all culture, past and present, are the inevitable expression of the particular operation of biological genes. To put it most succinctly, this is what is called genetic determinism. For example: 'In hunter-gatherer societies, men hunt and women stay at home. This strong bias persists in most agricultural societies and, on that ground alone, appears to have a genetic origin' (Wilson 1975: 48). Wilson also states that 'the genes hold culture on a leash. The leash is very long but inevitably values will be constrained in accordance with their effects on the human gene pool' (*Idem* 1978: 172). Seen in this light, the contemporary cultural world is a product of natural selection of biological genes. Therefore this world is in fact the best of all possible worlds as Leibniz once claimed.

Biological genes are only interested in replicating themselves. Speaking figuratively, they are thoroughly selfish. Nevertheless, the culture we live in encourages altruism and honors altruistic behavior. How can the reductionistic model explain these phenomena? Wilson asks how the altruistic behavior is possible in the evolutionary mechanism of the struggle for existence, indicating that altruism is at the center of the theoretical issues discussed in sociobiology. Altruism is divided into three forms: kin, reciprocal and group altruism (cf. Singer 1981: 21). Each of them appears to lower the fitness of the subject but raise the fitness of others.

Now we need to answer the following questions:

(1) As a result, is the altruistic behavior the selfish behavior of biological genes? (2) Ultimately, is there no qualitative difference between animals and human beings in their altruistic behavior?

Wilson answers 'yes' to question (1) and 'no' to question (2). He regards kin altruism as the core of all forms of altruism. Even though altruism can be transformed or promoted by cultural learning, nevertheless, from a reductionistic perspective, culture cannot be completely dissociated from the adaptation of biological genes. This implies that ethical behavior is not a phenomenon specific to human communities but something common in the animal kingdom.

However, there are some cultural phenomena contrary to biological desire. Birth control is a typical case. Obviously it runs counter to biological fitness that married couples refuse to have more children, even if they have sufficient means to support those children. The more educated women are, the more favorable they are to birth control. This phenomenon cannot be explained by genetic explanation models.

Non-reductionists see it such that, although culture may indeed seem to arise from the world of biological genes, once created cultural genes begin to evolve within a particular world, they may then cooperate with biological genes, but sometimes they may compete with or even be pitted against biological genes. In this way, non-reductionist explanatory models account for the evolution of cultural genes not by forging a connection with biological genes, but through the positing of an independent process. We can find the typical example of this model within evolutionary epistemology. How do theories and knowledge survive within a state of competition? Why do some theories survive and why does some knowledge disappear?

Karl Popper can be said to offer the most elaborate proposal of this sort of evolutionary epistemology. Popper is a philosopher who has ever suggested evolutionary epistemology in its most sophisticated form. In his book *Objective Knowledge* (subtitled *An Evolutionary Approach*), Popper (1979) argues that from the amoeba to Einstein, the growth of knowledge is a process of trial and error or a process of conjecture and refutation. However, all this is nothing more than a different name for random variations or

selective replication. It is based on the evolutionary mechanisms of variation, selection and replication.

We can then pose the following question: if we apply an evolutionary theory that does not suggest progress, can it really be possible to assert the progress of knowledge? It seems not. This is due to the fact that Herbert Spencer's notion of progressive evolution has been superseded by modern evolutionary theory, and when we assert an evolutionary epistemology, there does not seem to be any logic in stressing the progress of science. To paraphrase S. J. Gould, evolution does not imply progress (Gould 1996). To put it another way, evolution is but a process of adapting to an environment; it implies no progressive advance along increasingly superior stages. What are the grounds by which we could assert the growth or progress of knowledge in terms of evolutionary theory? Pragmatists assert that it is very difficult to explain the progress of knowledge if we utilize evolutionary theory not as a metaphorical tool, but rather in a realistic sense. It is from this position that Campbell supports a pragmatic evolutionary epistemology (Campbell 1987: 47–90). On the other hand, objectivists assert evolutionary epistemology also asserting objective knowledge and its progress. Understanding knowledge through the rationality, they think that rationality becomes the criteria for knowledge's 'survival of the fittest'.

Even though we advocate an evolutionary epistemology, there is no absolute need for us to become pragmatists. There can be differences in the criteria of survival for the fittest theories and the criteria of survival for the fittest biological gene. This is because in the world of science, which is a world of rationality, the 'fit' theories are imbued with objective truth. Put another way, the criteria of survival for theories differs from the criteria for genes. This means that adaptations of cultural genes are not the adaptations of biological genes, for cultural genes pursue only the adaptation of themselves. It is also the reason why it is appropriate to use a non-reductionist explanation in the cultural sphere.

CONCLUSION

In order to understand the history of a certain age, we must understand that era's science and technology, its ideology or system of governance, and its way of life or artistic mode. This is because each of these constitutes an important part of what forms the world that we live in. Furthermore, it is only these parts that allow us to

explain the causes behind historical changes, like when we ask, 'Why did society change from its feudal form into modern civil society?'

Explanations of culture based on cultural genes offer a new model of explanation for history and its transformations. Any simple system or lifestyle is founded entirely upon the composition of cultural genes. We can look at cultural genes as atoms. In order to properly explain the state of molecules, we must descend to the level of the atom. Then we must clarify how it is that atoms move about and combine with one another. The strong point of the cultural genetic explanatory model is precisely in confirming the identity of cultural genes and explaining their transformations through an evolutionary framework.

If we seek to explain the cultural changes of an era within the boundaries of our currently accepted debate, we must begin with the confirmation of cultural genes. We must then show how those cultural genes transform within an evolutionary mechanism and through what structure these genes combine. This is the manner that can be said to be the most reliable method to explain the cultural changes of an age.

From the discussion above, I have come to the following conclusion: Cultural change can be evolutionarily explained, centering on cultural genes, but this explanation is made independent of explanations involving biological genes. Therefore, the evolutionary explanation models of cultural change must be non-reductionistic, because this is the most rational approach to the explanation of cultural change.

Culture is never anything entirely irrelevant to the biological desire of human beings. As living beings, humans are an extension of biological evolution and have to meet the genetic desires on a preferential basis. Culture is a device that makes it reasonably possible to satisfy such basic desire primarily. Nevertheless, once a culture is formed, it starts to evolve independently and exercise its influence. For example, we see the developing process of complex artifacts including computers. Brand-new computers of higher performance come out day by day. This phenomenon is difficult to explain without assuming that the cultural genes of computers evolve independently. Likewise it is difficult to explain an elephant's long trunk or a lion's sharp teeth without the assumption of biological evolution. Just as it is unreasonable to hold that the ex-

planation of biological evolution relies only on the laws of physics, it is also unreasonable to explain cultural evolution based only on the evolution of biological genes.

Biological genes and cultural genes are interrelated in their evolution. Biological genes place restrictions on culture by preferentially spreading cultural genes that meet biological desire. On the contrary, cultural genes exercise their influence over biological fitness by influencing behavior and work to transform the world of biological genes. We call this phenomenon ‘meme-gene co-evolution’ (Blackmore 1999: 93).

In adopting this methodology, I do not believe there is any necessity to see human beings as the mere instruments of cultural genes. Blackmore states: that human being is an instrument of cultural genes, and that human consciousness, free will, and creativity are illusions created by cultural genes. However, this analysis does not offer sufficient explanation of the destruction of cultural genes. Though we are all born within cultural genes and find ourselves almost continually immersed within their influence, at the same time we are also the destroyers of cultural genes. We can destroy whole civilizations as we did through the first and second world wars. This is the evidence that we are not the mechanical puppets of cultural genes.

NOTE

* Cf. My Korean paper ‘An Evolutionary Explanation Model of Cultural Change’ (Chulhak, vol. 94, 2008). This paper revises and supplements the thesis of the Korean paper. I deeply appreciate the comments of Professor Herbert Barry III on this paper.

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