

CULTURAL SOFTWARE

A THEORY OF IDEOLOGY

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3 MEMETIC EVOLUTION

The last chapter offered some analogies between the cultural bricolage of human beings and the evolutionary design of natural selection without suggesting that the two are fundamentally the same kind of process. In this chapter, I want to take up the question of cultural evolution more directly. I argue that there is a significant Darwinian mechanism at work in cultural evolution. However, it does not operate through the natural selection of human beings or groups of human beings. What is replicated and selected in cultural evolution is not human beings but cultural information and cultural know-how in human beings. What is replicated and selected in cultural evolution is cultural software.

Evolution by natural selection requires the “differential survival of replicating entities” in a given environment.¹ More specifically, it requires (1) entities that replicate, (2) a source or mechanism of variation that continuously provides differences among entities, (3) a means by which variations can be passed on to future replicants, (4) an environment in which the entities replicate, and (5) different degrees of survival for different entities within the environment. If all five conditions are met, a process of natural selection results, producing highly complex and differentiated entities over time.²

Nothing in this formulation requires that the replicating entities be organic in nature; the first self-replicating entities on this planet may even have been bits of clay, whose slower replication was swamped by the earliest forms of organic life.³ Hence the principle of natural selection should also apply to units of cultural know-how.

Memes and the Evolution of Cultural Software

Richard Dawkins has coined the word *meme* (rhymes with *cream*) to describe these units of cultural transmission. *Meme* derives from the Greek *mimesis*, or imitation, and may also be considered to be a pun on the English *memory* and the French *même* (same).⁴

Memes are the building blocks of the cultural software that forms our apparatus of understanding. Memes are spread from person to person by observation and social learning—either face to face or through media of communication like writing, television, or the Internet. Through observation and social learning, people internalize and assimilate skills, beliefs, attitudes, and values, and these become part of their cultural software. In this way, memes are communicated from mind to mind, are adapted into our cultural software, and become a part of us. Culture is a system of inheritance: we inherit our cultural software from the people around us, and we pass it on to those whom we in turn communicate with.⁵

We use memes to understand, yet memes also “use” us, because they are inside us. Our tools of understanding are constructed from and with the skills and abilities that memes collectively provide. A person is a human being inhabited by memes, a complicated symbiosis of organism and cultural skills. People are complex combinations of their biological inheritance and cultural software, mediated through environmental influences; the information they carry is a combination of their genes and memes.

There are as many different kinds of memes as there are things that can be transmitted culturally. They include skills, norms, ideas, beliefs, attitudes, values, and other forms of information. Examples of memes (or groups of memes) include how to perform a particular dance step; how to build a flying buttress; a tune; a political slogan; how to order a meal in a restaurant; and belief in a divinity. Memes are primarily skills and abilities, but they also include beliefs about the world, paradigms of research, expectations about appropriate conduct (including the conduct of others), lyrics to songs, and ways of pronouncing particular words. Memes encompass all the forms of cultural know-how that can be passed to others through the various forms of imitation and communication.

Linguistic abilities are primary examples of memes, but so, too, are bodily or kinesthetic skills, for bodily movements are as important to culture as belief systems. Body language and dance; athletic, artistic, and craft skills; gestures, expressions, and other bodily movements—all are to some extent transmissible and hence can constitute memes or complexes of memes. Indeed, imitating and improvising bodily movements may be one of the most basic forms of cultural transmission.

Most writers on the subject have thought of memes primarily as beliefs or ideas that can be stated in propositional form.⁶ This equation is unfortunate. Transmission of culture is primarily transmission of cultural know-how. That is one point of the tool metaphor; a tool allows the self to do something.⁷

Much of the richness of cultural life is lost when we insist on reducing skills to information of a propositional form. Culture does involve information that can be stated in propositional form. Yet this information is valuable because it enables. Hence in describing units of cultural transmission, we must understand *knowing that*, or even *believing that*, as a special case of *knowing how*.⁸

Other writers have argued that representations are the basic units of cultural transmission. Dan Sperber, for example, distinguishes two basic types of representations. Mental representations are beliefs, intentions, and preferences. Public representations are signals, utterances, texts, and pictures; they include what other writers have called symbolic forms.⁹ Sperber's emphasis on representations, while helpful, is also incomplete. It does not take into account cognitive mechanisms like associations. As Sperber points out, the most important fact about public representations is that they represent something to someone. The question left unanswered is what allows them to have this representative character. The answer must be in terms of certain cognitive skills that have also been transmitted to others. These skills cannot be reduced to either beliefs, intentions, or preferences. Hence in addition to representations, a theory of cultural transmission needs to grant a central place to cognitive skills.

Although beliefs and mental representations are surely part of cultural software, they are not the whole story. We are more than collections of or receptacles for beliefs and representations; we are embodiments of cognitive skills that produce and interpret beliefs and representations. Focusing on the centrality of cognitive skills helps us remember that culture enables the mind rather than simply fills it up.

The standard view of memes as beliefs is remarkably similar to the standard view of ideology as a collection of beliefs. Both conceptions are unduly limited. Understanding ideological phenomena requires us to look at psychological and cognitive mechanisms that produce beliefs. They include informational filters, heuristics, narratives, scripts, associations of meaning, and metaphoric and metonymic models. These mechanisms are also culturally transmitted and are endemic to cultures and the beliefs of their members. These forms of cultural software are the major concern of Chapters 8 through 11 of this book.

Our ability to assimilate new cultural software often involves the use of existing cultural know-how and hence employs memes or complexes of memes that have previously been transmitted and internalized. In order to learn a theorem in physics, for example, a person must already be able to speak a language, must already have some knowledge of mathematics, and so on.

Memes prepare the way for the absorption of other memes—this progression is another example of the cumulative nature of conceptual bricolage.

The theory of cultural software distinguishes between a person's apparatus of understanding and the public representations or symbolic forms that people understand. Cultural software properly refers to the former and not to the latter. Cultural software consists of tools of understanding that exist within minds. Units of cultural transmission can be stored outside minds—in writings or computer disks, for example—and they can be manifested in utterances and public symbols. But these forms of storage and these manifestations are not cultural software. Nevertheless, the information contained within them can become part of a person's cultural software when it is understood or assimilated through communication or social learning. Although a book does not, strictly speaking, contain cultural software, reading a book may add to or alter our cultural software because we absorb or are influenced by information contained in the book.

This distinction is important because the word *meme* has generally been used more loosely to describe both units of cultural transmission that exist outside of a person's apparatus of understanding and units of cultural transmission that have become elements of that understanding. Thus we can say that a book or a television program contains memes, and that people absorb memes from watching television or reading books. Memes absorbed in this way can then become part of a person's cultural software. So not all memes are currently part of some person's cultural software, although all cultural software consists of complexes of memes that have been assimilated into or initially created by minds.

Memes, like genes, are units of inheritance, but the inheritance is a cultural inheritance. We inherit our genes from our parents. But we can inherit our memes from anyone we learn from, imitate, or communicate with. We pass our genes on to our children. But we can pass our memes on to anyone who learns from us, imitates us, or communicates with us.

Evolutionary biologists distinguish between the genetic information coded in genes (the genotype) and the physical or behavioral effects of this coding on an organism in its environment (the phenotype). In the same way, we must distinguish between the information coded in memes (the "memotype") and the cognitive and behavioral effects that the meme produces in a person (the memetic phenotype). But because we do not yet know precisely how the brain stores information, beliefs, and skills, we can say very little about the memotype, and we must study memes largely through studying their phenotypic effects.

Memes must correspond in some way to features of the human brain, but we do not yet know exactly how. Each brain is different and may store infor-

mation in different places. There may be no uniform way that information is stored in different brains, and hence the comparison to chromosomes may be particularly inapt. People whose brains are damaged can sometimes relearn skills using other parts of their brains. Moreover, as Daniel Dennett points out, it would be amazing if “the brain-cell complex that stored the original meme for bifocals in Benjamin Franklin’s brain was the same as, or very similar to, the brain-cell complex that is called upon today to store the meme for bifocals whenever any child in Asia, Africa, or Europe first learns about them—by reading about them, seeing them on television, or noticing them on a parent’s nose.”¹⁰ Nor can we say that the culturally transmissible skill of cello playing corresponds to particular chemical and physical states in the brain coupled with particular configurations of muscles in the hand and arm that are identical for each individual cello player. What makes two examples of a meme in different persons the same is the similarity of the cultural know-how they provide, not the similarity of the ways they are stored in the human body.

Dennett argues that what is preserved in cultural transmission is cultural information in a media-neutral, language-neutral sense.¹¹ One need not make this assumption, however. First, as media theory reminds us, the medium of transmission may be an important part of the message conveyed. Second, the idea of a media-neutral content of information presumes that social communication essentially involves coding and decoding an identical message. Yet social learning and communication of bodily skills may in fact be much more complicated than this.

For example, the process of advertising does not involve merely a coding of information that is designed to be decoded. Rather than simply convey information, it tries to create similar preferences in different people. Much human communication requires the parties to infer and supplement what is being conveyed rather than simply uncoding it.¹² Finally, the metaphor of coding and decoding an identical media-neutral message is particularly unhelpful in describing how someone teaches another to kick a football, shape pottery, or play a musical instrument. In such cases, we should rather say that the mind and body, through social learning, create their own individual skills similar to but not necessarily identical to those perceived in others. This is a form of replication, to be sure, but decoding is not the appropriate metaphor.¹³

Genes usually replicate in complexes or groups, called genomes. It is likely that culture is also transmitted in complexes of memes, or memomes. Before the discovery of the biochemical vehicles of genetic inheritance, it was difficult to determine where genes began or ended. Scientists had to make inferences about the boundaries between different genes from their phenotypic effects on an organism’s physical features and behavior. Often (as in the case of blue eyes) a phenotypic effect is the result not of a single gene but of a combination of

genes, but scientists could not determine this until they understood the biochemical basis of inheritance. Because we do not know precisely what biological vehicles carry memes, it is hard to separate the meme from the memome in the way that we can now separate some genes from their genomes.

These limitations in our knowledge raise a problem of demarcation and division. Is Beethoven's Fifth Symphony a single meme, or does the four-note motto that begins the piece qualify by itself? The solution to this difficulty is entirely pragmatic, as it is in the case of genes. Multiple traits are often passed together from parent to offspring—for example, a certain shape of nose and a certain eye color—but we can say that the gene is the smallest unit of genetic information that can be and is repeatedly transmitted more or less intact. In a similar spirit, we can say that memes are the smallest units of cultural skills or information “that can replicate themselves with reliability and fecundity.”¹⁴

This solution does not eliminate all difficulties. Daniel Dennett argues that that the notes D-F#-A do not constitute a meme, while the theme from the slow movement of Beethoven's Seventh Symphony is a meme. Just as a single codon of DNA like C-G-A (coding the amino acid arginine) is “too small” to be a gene, Dennett believes that the effects of the notes D-F#-A are insufficiently individual to count as a meme. A “three nucleotide phrase does not count as a gene for the same reason that you can't copyright a three-note phrase: it is not enough to make a melody.”¹⁵

Dennett's argument misses an important difference between genetic transmission and cultural transmission. The biochemical vehicles of genetic transmission place lower limits on the size of the units of transmission. A three-nucleotide phrase cannot be a gene because of the biological structure of genes. But cultural transmission works very differently. A skill or a piece of information can be a building block of other, larger elements and yet also operate as a meme in its own right in other contexts, as long as it has some independent memorizable meaning to an audience. Moreover, the length of the sequence is not the only factor. The cultural expectations of audiences (which include their own preexisting cultural software) help determine what is reliably memorable and what is not. Thus, the musical phrase F#-E-D played at moderate tempo represents the song “Three Blind Mice” to people living in certain cultures. Because these three notes played slowly call that song to mind, they can serve as a symbol of the entire piece. And a symbol—something that stands for something else to someone in some context—is a particularly salient example of a meme. Note, however, that these three notes played slowly also begin the second subject in the first movement of Tchaikovsky's *Pathétique Symphony*.¹⁶ The first F#-E-D is a meme, but the second (at least currently) is not.¹⁷

We now see why Dennett's analogy to copyright law is mistaken. The

reason why the law does not permit short phrases to be copyrighted has nothing to do with the phrase's inability to have significance or to be memorized reliably and repeatedly. It stems from the fear that the owners of the copyright could demand royalties for each and every use, thus stifling creativity. Protection is denied not because short phrases cannot be memes but because they can be memes. Because units of cultural transmission can act both as independent units of meaning and as building blocks for other units, the law does not allow the very smallest units to become intellectual property; excessive property protections may block larger, socially beneficial constructions.¹⁸

This example raises one of many important differences between biological and cultural evolution. Memetic evolution may be a process of natural selection, but it does not necessarily occur in exactly the same way as biological evolution, or use precisely analogous structures and techniques. Many features of biological evolution may result from the particular requirements of biological replication and designoid structures arising earlier in the development of life on this planet. For example, biological evolution on Earth makes use of DNA and RNA, alleles and codons, because of the particular way that life originally formed and was able to reproduce itself. There may have been many different possible biochemical structures of biological reproduction and evolution, but organisms on this planet hit upon a particular one and successively built upon it. The structures that we discover in genetic evolution may not be in any sense necessary to evolution but may simply be the ones that evolved historically to transmit genetic information—given the constraints of the particular biological organisms that were first able to carry and reproduce this information through their own growth and reproduction. It does not follow that all forms of evolution through natural selection require analogous structures of transmission and evolution.

We should use the concepts of biological evolution to the extent that they can serve as a useful heuristic to understanding cultural evolution. We can start with a model of evolution that we already know something about and use it as our point of departure for studying other forms. But if we rely too heavily on biological analogies, we will inevitably be misled, because biological evolution is only one possible form of evolutionary development. We must always be on the lookout for disanalogies. Indeed, discovering these disanalogies often is as helpful in understanding cultural evolution as discovering analogies.

Memes as Populations

Like genes, memes are self-replicating entities, but the environment in which they replicate consists of human minds and the places for external information storage that humans have devised. At any point in time there is a “meme pool”

of memes competing for survival in the environment of human minds, just as there is a gene pool that competes in its environment. No two human beings have the same memes; there are no identical cultural twins. Every human being is a unique individual, and not simply the replication of a cultural template.

Both the study of cultural evolution and the study of genetic evolution by natural selection employ what Ernst Mayr has called “population thinking.” Species are populations of slightly different organisms that carry slightly different combinations of genes. The frequency of these genes in the overall population changes depending on how organisms interact with the environment. Individuals with genes favored by their environment have better chances to survive and produce more offspring. Over time, the species evolves because of the changing composition of its gene pool. Viewing species as populations means that species are not essential, unchanging types, and members of a species are not imperfect examples formed from a standard template. “There is no ‘typical’ individual,” Mayr points out, “and mean values are abstractions.” Variation is not only characteristic of individuals, it is essential to the forces of change. As Mayr puts it, “he who does not understand the uniqueness of individuals is unable to understand the working of natural selection.”¹⁹

A similar analysis applies in the world of culture. Each person is constituted by a population of memes—her cultural software—and the entire population of human beings represents an even larger population of memes. We can think of cultures, subcultures, and interpretive communities as populations of partly similar, partly different memes reflecting partly similar, partly different cultural software in individuals. Cultures, subcultures, and interpretive communities are neither natural nor supra-individual entities; they are effects of or useful abstractions from the slightly different cultural software of their members. Cultures have conventions and institutions that help to reproduce the cultural software of their members. Yet these coordinated behaviors are also the effects of the similar but slightly different cultural skills of their members. The cultural and the individual thus tend to fade into each other: what is cultural consists of widely spread and long-lasting memetic features of individual members of the culture, just as the species consists of the widely spread and long-lasting genetic traits of individual members of the species.²⁰

We can reinterpret the concept of a cultural tradition in these terms. There are two ways of understanding a tradition: one synchronic and the other diachronic. These two visions of tradition correspond roughly to two different ways of thinking about species—synchronically, as a population of relatively similar individuals with relatively similar genes existing at a given point in time, and diachronically, as a line of genetic descent.

Viewed synchronically, a tradition is a set of ways of thinking through which people understand and live at a particular moment in their lives.

Traditions involve populations of relatively similar memes that constitute the people who live within those traditions. A tradition produces a particular perspective or horizon—the way of seeing and understanding the world that makes use of the cultural software that one has. The shared perspective among the members of the tradition is due to the similarity of their tools of understanding.

Diachronically, a tradition is an ongoing process in which members inhabit one particular, though not necessarily privileged, moment. The tradition is reproduced in successive generations, but it changes over time and may have transformed itself considerably in the process. What allows people to think of themselves as “traditional” Jews, for example, is not the belief that they are doing exactly what people did 3,000 years ago in ancient Israel.²¹ Rather, it is the belief that there is a genealogical continuity between what others who called themselves Jews did in the past and what one is doing now. This approach views tradition as a line of memetic descent, in which the memes possessed by the members of the present interpretive community can be seen as linked through a chain of communication and education with the memes of earlier members. Because memetic evolution occurs much more rapidly than genetic evolution, traditions may evolve and change quickly, and over time many of their core beliefs, practices, and rituals may be displaced, despite our ability to trace a transhistorical continuity of transmission.

The environment for memes consists of human minds and methods of memory storage. There is a limited number of minds in a geographical area, in a particular culture, or in the world. Each mind has limited time for social learning and limited information-storage capacity. Memorization or achievement of a skill not only requires exposure to cultural transmission; it also requires conversion from short-term memory to long-term memory. Repeated exposure and practice may be necessary if the skill is to endure and become second nature.²²

Moreover, even though memes can eventually be stored outside of minds, they still need the intervention of minds at crucial points for their replication and continued survival.²³ Hence human minds create a bottleneck for the replication and storage of cultural skills and information. Memes must compete for available space. Variation among memes causes different rates of survival and propagation. Memetic competition for available space in the minds of human beings creates gradual changes in the population of memes in a particular geographical area, or in a particular culture or subculture. If the survival rates differ enough, particular skills may become extinct or die out. Languages, for example, die out when insufficient numbers of speakers are available to reproduce them. The same is true with bits of information or bodily skills. If everyone forgets how to do the rhumba (and no external records of how to perform

it remain), the rhumba goes out of existence, although something like it may be invented in the future.

Indeed, not only is there competition among memes and meme complexes for instantiation in human minds, there is competition within each human mind for those memes that are most easily remembered, repeatedly transmitted, and frequently employed. People use some skills more frequently than others and forget some things more easily than others. They bring some skills to bear more often and other skills less often. They develop some skills more and other skills less. They think and talk about some things more frequently and others less so. We might say, loosely speaking, that a human mind is a population of competing memes that exists in a larger population of competing memes called a culture, a subculture, or an interpretive community.

One of the most important parts of the environment that memes face are other memes in the meme pool and the behaviors and beliefs they produce. Thus memes not only compete, but they also must adapt to the existence of other memes and may even benefit from or depend on other memes for their continued survival. Many memes in human culture survive and propagate only because human beings already have internalized and mastered certain linguistic skills and vast quantities of information and cultural know-how. Previous education is often necessary to comprehend, recall and utilize newer skills and information. Some memes, like some genes, can even be coadaptive, so that they mutually assist in each other's survival.²⁴

Memetic Variation

An important difference between cultural and genetic evolution concerns the frequency of variation. Genes usually make very good copies of themselves; mutations are a relatively rare occurrence. The same is not true in the world of culture. Cultural transmission requires communication, imitation, or some other form of social learning. The copies produced by this process are rarely identical to the original. Misunderstandings occur, or, more frequently, partial understandings occur that are good enough for one purpose but not for another, unforeseen purpose. Skills require practice to be perfected; the need to practice them means that the earlier attempts will be inartful and that later attempts will draw heavily on the recipients' own personality and abilities. Just as no two people dance, cook, or play the cello in precisely the same way, no two people understand social conventions or situations the same way. As they pass these skills and understandings onto others, further change occurs.²⁵

Memetic mutation occurs not only because of misunderstanding or because old signs are inserted into new contexts. It also occurs because of inno-

vation. Human beings are not passive receptors of memes; they are active processors and recombiners of the cultural messages and skills they receive from others.

First, human minds combine and adjust the memes they receive with those they already possess.²⁶ For example, people have filtering mechanisms for receiving new information; they may discount information if it conflicts too greatly with what they already believe.²⁷ Similarly, the theory of cognitive dissonance suggests that people may reconfigure new ideas and understandings to achieve intellectual coherence with their existing beliefs or to preserve their sense of themselves.²⁸ People also create new memes when they learn through trial and error.

Second, individuals are creative. They modify skills, combine information, draw inferences, and stretch conventions. To be sure, people always do these things by making use of the cultural software they already possess. But this fact does not make their activity any less creative; indeed, their cultural software enables their creativity by providing thought with a necessary framework for problem solving and innovation. In short, human beings are not simply Xerox machines for their memes; they are also incubators for new memes, as well as master chefs who combine old memes to create new memetic recipes. We send our newly created memes out into the world, where they are received, assimilated, adjusted, recombined, and modified by countless other minds, each creative like our own. The power of human reason, made possible in part by the memes we possess, is also the power to mutate those memes and create something new from something old. We are not simply the inheritors of a zealously guarded patrimony but entrepreneurial producers of new cultural software, which will help constitute future generations of human beings. So the story of memetic evolution is neither the story of our slavery to memes nor the story of how human reason enables us to break free of this slavery. Rather, it is a story of the collective creation of human reason, a story of powers of heightened creativity made possible by previous memetic infestations, a story of freedom mixed with, and paradoxically made possible by, constraint.

Because human beings are creative and combinatory, the path of cultural evolution must necessarily be different from that of genetic evolution. In the *Origin of Species*, Darwin used the metaphor of the branches of a tree to describe the basic trajectory of evolution.²⁹ Life on Earth, he argued, has a single origin. Different species diverge from this root at different times, further subdividing into new species. This topology means that as species evolve, they separate into ever new forms, and the proliferating branches never recombine. But the history of cultural development is quite different. Cultures do tend to diverge because of geographic isolation or disciplinary specialization, but later people often borrow from other cultures to supplement their own. For example, Amer-

ican cuisine—which includes such delicacies as deep-dish pizza, hamburgers, and chop suey—borrowed from other cultures to create dishes that did not originally appear in those cultures. (Though to be sure, the spread of American culture in the twentieth century means that now one may indeed be able to get hamburgers in Hamburg, deep-dish pizza in Rome, and chop suey in Hong Kong—yet another example of cultural recombination.) A similar point applies to technological development. Inventors often look for solutions by lifting ideas from widely divergent cultural sources: the use of computer punch cards to store information, for example, was inspired by the Jacquard loom, which was in turn based on the earlier technology for constructing automated pipe organs.³⁰ This sort of cultural borrowing is yet another example of the bricolage described earlier. In sum, one of the most important distinctions between genetic and cultural evolution is that while biological lineages increasingly diverge, cultural lineages often recombine.³¹

A second important distinction concerns the mechanisms of replication and survival. As noted earlier, in the cultural world, transformation is the rule and exact copying is the exception. Moreover, much cultural transmission is not a process of coding and decoding an identical message; it may involve creating similar cognitive skills through imitation and inference from salient examples. An evolutionary theory of culture based on the differential survival of replicating entities must take these facts into account. If memes are constantly being transformed as they spread, the mechanism of differential survival must operate differently in the cultural and biological worlds.

The survival of cultural software does not depend solely on different rates of attractiveness or acceptance by human minds. Human beings inevitably transform what they receive from others; even if I like what I see or hear, it will be changed when I pass it on to others. This presents a real problem for memetic survival: if transformations were purely random, they would eventually destroy the identity of what spreads. If people randomly transformed different elements of an original story each time it was told, after a time there would be not a single version that was widespread but a random distribution of many different stories. For memes to be successful replicators, it is not enough that they have descendants; they must also have sufficiently similar descendants.

A particular kind of cultural software will not become widespread in a population unless its transformations are systematically biased in particular directions, or tend to converge on a central set of features. Put another way, if a particular kind of cultural software does become widespread, it is probably because some types of creative change or transformation of that software are more likely than others. What becomes widespread is not only what resists transformation but what gets transformed, in roughly the same way by many different people.³²

Human psychology and cultural factors play a central role in these subsequent transformations. For example, people are more likely to retell those elements of a story that are most salient and easily memorized; they are more likely to forget or transform others. In this way psychological properties of memory and relevance determine how some parts of stories are retained, how other parts get transformed, and how those transformations converge. Transformations may also converge because of the force of existing cultural expectations. A story with an inconclusive ending will probably gain a happy or a sad ending if it is repeated often enough. Here multiple transformations may lead to the spread of two different stories with different endings. Conversely, the process of transformation may tend to combine different varieties of cultural software. Two or more different stories may eventually converge into a single story because successive recountings of each get transformed toward a common version.

In describing the spread and success of cultural software, therefore, we must consider effects on the “demand” side (what kinds of memes are most attractive, salient or useful to other minds) and on the “supply” side (what kinds of transformations memes will undergo as they are communicated to other minds). In the biological world, the problem of guaranteeing similarity among descendants is not very great because the biochemical mechanisms of copying tend to be fairly accurate. Hence the most important determinant of reproductive success is selection by the outside environment. But in the cultural world, a meme must contend with both the outer environment of other minds that might be receptive to it, and the inner environment of the mind that propagates and transforms the meme. It must survive in both environments, and it must survive in ways that retain its commonality with other memes.

Problems of Transmission

In order for memes to replicate, they must be embodied in some vehicle. People are the most important vehicles for memes, but books, records, and computer disks also serve as vehicles for cultural replication. Technology itself can serve as a meme vehicle. The very existence of a wheel suggests to us the fact that such a tool can be created, how to create it, and how to use it.³³ The amount of information technologies convey about themselves is necessarily limited, however, especially as the technologies get more complex.

If all of a meme’s physical embodiments (including all human memory storage) are destroyed, the meme becomes extinct, although something like it can be invented anew. The durability of a particular vehicle does not necessarily guarantee reproductive success over time. Many insect species have existed for millions of years, even though the lives of individual insects are comparatively

short. Rather, it is more important to produce many copies than to ensure that all the copies survive for long periods of time.³⁴

Cultural evolution is not possible until there are sufficiently powerful information-processing devices capable of storing information and reliably transmitting it to or replicating it in other information-processing devices. Animals have rudimentary abilities to produce culture and pass it along to their offspring. Animals can learn skills and imitate movements, and some even have rudimentary semiotic and linguistic skills.³⁵ Birds can imitate songs and transmit them from generation to generation, and these songs can even mutate over time.³⁶ But if a pigeon sees a copy of Shakespeare's *Hamlet*, it cannot assimilate the memes contained in that play. Even if an animal could memorize a particular skill or particular information, the skill or information dies with the animal if it cannot transmit its mastery reliably to others. Fecundity, transmissibility, and longevity—three essential requirements for a process of natural selection—were not sufficiently present before the evolution of humankind.

Once comparatively large-brained human beings arrived on the scene, and invented language, however, memetic evolution really took off.³⁷ Fecundity was greatly increased because many different kinds of memes could be transmitted to many people at once through vocal communication, observation, and imitation. The memes involved in linguistic ability greatly enabled the transmission, processing, and storage of other memes, which in turn enabled the transmission, processing, and storage of still others. Longevity was enhanced because even though a particular person died, her information could be passed on to others. This environment was still somewhat inhospitable for memes because it relied so heavily on human memory for storage and on human speech and movement for transmission. The next great advance in memetic fecundity, transmissibility, and longevity was the invention of external forms of information storage: first through writing, then by means of printing presses, and in our own day through the use of digital computers. With the invention of writing it became possible for the ideas of an ancient scholar like Plato to survive into this century without having to be fully memorized by an unbroken chain of individual memories. Indeed, to the extent that external forms of information storage are more durable than human memory, there may be some comparative advantage for memes to convert human memories into these more durable forms. It is this possibility that underlies Dennett's wry suggestion that a "scholar is just a library's way of making another library."³⁸

The development of extrinsic sources of information storage is important for another reason. As we have seen, the human mind is a natural bottleneck for memetic evolution, because memes usually must reside in a human mind before they can be transmitted to others. The scarcity of human minds is an important element of the natural selection of memes. Increase in the brute number of hu-

man beings eases this bottleneck to some degree: for example, it makes possible (but by no means guarantees) a flowering of knowledge that might not have been possible in earlier times. Nevertheless, the bottleneck remains.

On the other hand, if computers become sufficiently developed, human mediation and incubation of memes may become increasingly unnecessary. To begin with, after a certain level of technological innovation is reached, it becomes possible for information to propagate without its contents being directly stored or understood by any human mind. Whenever computers communicate with each other or copy files, for example, information is propagated whether or not it is ever accessed by a human mind. A human mind is still necessary to design, program, and repair the computers, but it is not necessary for a human mind to think all the information the computers contain. Eventually, it is possible that more and more features of maintenance, programming, and design could be left to computers themselves. A rudimentary example is the current use of computers to design computer chips.

The creation of new propagation and incubation devices might ease the bottleneck of memetic growth and thus drastically change the course of memetic evolution. Indeed, it is quite possible that some memes may presently find computers a more hospitable environment for development than the human minds that their ancestors originally inhabited (and spurred on to construct computers). Of course, the features that benefit a meme's survival and propagation in a computer's memory banks may be quite different from what guarantees its survival in a human brain or on a piece of paper. Hence memes that successfully inhabit computers may evolve differently and possess somewhat different features from those of their human-dwelling cousins.

In order to reproduce successfully, memes must be able to transmit themselves from one mind to another. Originally, this must have presented an enormous hurdle. One cannot simply copy cultural software onto a brain as one would load software from one IBM-compatible computer to another. Copying software is easy on these computers because each has identical physical structures for reading and coding data and an identical hard-wired machine language. By contrast, copying and running software on computers with different and proprietary hardware is actually a fairly difficult task. At the beginning of the personal computer revolution in the 1970s and early 1980s, for example, there were literally dozens of incompatible computer designs, none of which could load or run one another's software. Many computer manufacturers eventually went bankrupt because their machines were not 100 percent IBM compatible. Our image of computer software as something that can be easily popped out of one computer and into another is really the result of competitive pressures that weeded out most designs for personal computers until the IBM and Apple designs achieved market dominance in the mid-1980s.

Human beings are decidedly not like mass-produced IBM computers. The physical structure of each person's brain is different, a product of both genetic inheritance and subsequent development. The mental capabilities of human beings are more like a proliferation of different proprietary architectures, each with its own unique features. If we want different kinds of computers to talk to each other, we must create a program on each that can accommodate its architectural idiosyncracies. Each such program creates on the computer a "virtual machine" of software and hardware that can read and understand common instructions, and thus can speak a common language.³⁹

Because each brain's structured capacities are different, memetic exchange must occur through a mode of transmission that is, as Daniel Dennett puts it, "social, highly context-sensitive, and to some degree self-organizing and self-correcting." Put another way, if human beings can transmit and share cultural software, it must be due to the differential survival of memes that have a high degree of adaptability and tolerance for different mental environments.⁴⁰ At the same time, there must be some degree of commonality in the basic cognitive and linguistic apparatus of human beings to allow such hardy meme-skills to have developed in the first place. The scope and extent of this universality is the well-traveled terrain of the debate between Chomskyites and their opponents.

These transmission skills come in several varieties, including learning by imitation, through positive or negative reinforcement, and through natural language.⁴¹ Once these skills exist even at the most rudimentary levels in brains that are big enough for large numbers of memes to inhabit, the process of memetic evolution takes off, building its own "information superhighway" from previous meme-skills and facilitating the replication of more and more memes. Thus, just as human beings change their environment to make it more hospitable, memes without intention or plan develop and combine to create a more hospitable environment for themselves both in human brains and in extrahuman information-storage devices. The development of the first hardy memes that could create the virtual machines that facilitated transmission was itself the result of a process of natural selection. Memes that were able to do so successfully spread, while those that could not failed to take hold in the meme pool. Subsequently, other memes could and did take advantage of this newly fertile ground.

Memes as Filters

As I noted earlier, most theorists who discuss units of cultural transmission have focused on meme-beliefs, rather than meme-skills. This bias is similar to the general tendency to assimilate all features of ideologies to beliefs. Yet many

of the most important forms of cultural software—and particularly the most important for the study of ideological phenomena—are skills or cognitive structuring mechanisms that cannot be reduced to propositional beliefs. A good example of such a meme-skill is a filtering mechanism.

It is clear that beliefs can act as filters; an example is the notion that one shouldn't believe anything printed in a particular publication or spoken by a particular politician.⁴² But filters do not have to exist in the form of propositional beliefs. Many cognitive mechanisms, including prejudices, narrative structures, metaphoric models, and metonymic associations, act like filters. They let in ideas that conform to particular patterns of thought while rejecting those that do not. Psychologists have also discovered a series of heuristic mechanisms that people use to search for information and other mechanisms that people use to assess and discount information contrary to what they already believe.⁴³ These mechanisms also filter experience. Alternatively, cognitive mechanisms can actively adjust and shape new social experience so that it appears to conform to existing structures of thought and belief. Mechanisms of cognitive-dissonance reduction seem to work in this way.⁴⁴

We can put this point more generally. Many ideological effects are produced by memes that act as cognitive filters. There are many different ways that our cultural software can do this, and the study of how it does so is a large part of the study of ideological effects. Memes that act as cognitive filters become part of the environment for new memes that seek entry into human minds. These filtering memes help the mind to accept some meme candidates and reject others, or help adjust and reconfigure incoming memes to existing patterns of thought. Hence these meme filters are part of the mechanisms of natural selection that occur within each individual human mind. All other things being equal, memes that can most easily break through or accommodate themselves to the filtering mechanisms of an individual human mind are more likely to find room in the limited memory space available in that mind.

Moreover, because filtering memes help determine which memes are accepted in human minds and which are not, they are important mechanisms of natural selection of beliefs and skills within cultures, and indeed, across the entire population of human minds. All other things being equal, those memes that can most easily break through or accommodate themselves to the filtering mechanisms of people's minds will, over time, be more represented in the meme pool of a given population, culture, or subculture.

In sum, meme-filters help explain how human beliefs—and hence the ideological effects of those beliefs—develop and spread differentially. The idea of a meme-as-cognitive-filter links the study of memetics or cultural evolution to the theory of ideology.

But if meme-filters are an important source of ideological effects, and if

they are part and parcel of the natural selection of memes in the ecology of human minds, how are they themselves selected for in the first place? Why would human minds develop meme-filters as part of their cultural software?

The most important fact about information is that there is too much of it. Finite human minds need ways of taming the Heraclitean flux of experience. Thus filtering, organizing, and structuring information is a positive good, and memes that act as filters naturally arise to fill this need. Like all evolutionary innovations, such filtering mechanisms do not have to be perfectly designed. They need only be good enough for the purpose at hand and may have all sorts of unforeseen and unforeseeable side effects. This means that some mechanisms of filtering may be harmless or even quite helpful in some contexts but harmful, prejudicial, and unjust in others.

Our memes filter, organize, and structure social experience. They provide key components of the environment in which new memes will grow, develop, propagate, and perish. These filters and structures arise along with the proliferation of information. Hence increasing the amount of available information does not necessarily increase knowledge or understanding. It does not result in a person's being well rounded or well read, having an open mind or being receptive to new ideas. Indeed, under certain circumstances it can have precisely the opposite effects.

Encountering an explosion of information can foster closed-mindedness, because too many competing sources of information produce the potential for confusion. The flood of conflicting information creates a suitable environment for breeding ever new forms of memetic filters that harness the flow and shut out many different kinds of information. Some of these filters may include mechanisms that hide their own biases and limitations, because this tends to increase their success at propagation.

Thus we should not necessarily assume that the proliferation of new information sources and the coming together of many different cultures will produce the end of ideological conflict. Rather, the widespread availability of information and the collision of many different cultures and language games may in fact produce more narrowness of thinking, more inflexibility, and more intolerance, whether between ethnicities or between academic disciplines.

The development of memetic filters creates new bottlenecks for the propagation of memes. Memes that can break through or get around these filters have greater chances to spread in a population of minds. Thus complexes of memes develop means of evading filters: examples are the development of flashy graphics, large type, or loud music in advertising to attract an audience's attention. In response, new forms of filtering arise to keep pace. The result is a sort of "arms race" between memes seeking places in human minds and the filters designed to winnow them out.⁴⁵

Eventually, filtering and devices to get around these filters start to exist in symbiosis, so that it becomes difficult to distinguish between what is filtering and what is promotion designed to evade filtering. Advertising the status of an author, for example (through institutional affiliation or kudos on the dust jacket), can be used to signal that the work is worth reading, but this signal is also adjusted to known filtering mechanisms for deciding which works to read. Signals, in other words, are the flip side of filters. They are devices used to advertise quality or desirability to a potential audience so as get past informational filters. And as Dennett observes, “‘Blind refereeing,’ the proliferation of specialized journals, book reviews, reviews of book reviews, and compilations of ‘classic works’” can be seen both as filtering devices and as means to get through these devices and into human minds.⁴⁶

Memes as Viruses

Because cultural software is transmitted from person to person, there is a natural analogy between cultural software and viruses. The human mind is susceptible to memes just as the human body is susceptible to infection from particular viruses.⁴⁷ The study of cultural evolution is a study of comparative epidemiology. Some memes are more contagious, or “catching,” than others in a population and thus spread more widely and successfully.⁴⁸

The metaphor of susceptibility to viruses helps us understand the deep connections between the power of human intelligence and its vulnerabilities. Human beings are more susceptible to many more kinds of memes than, say, pigeons, precisely because they have a greater intelligence.⁴⁹ All forms of human understanding involve susceptibility to memetic invasion. Human beings are vulnerable to memetic infection precisely because they are so well developed as meme reception machines. Moreover, much of this infection does not involve someone intentionally sending a message to a recipient. We receive memes when we observe another person’s behavior or dress or when children pick up ideas or behaviors from their parents, teachers, or schoolmates. Just as children easily contract all sorts of diseases, they are particularly susceptible to memetic “infections” in all sorts of unintended ways. That is one reason why parents are so particular about what their children are exposed to.

People’s susceptibility to memes varies with the skills that they already possess. Our existing cultural software shapes what is salient, interesting, and hence what is easily communicated and easily absorbed. Although children learn all sorts of words that make their parents cringe, they are relatively immune from discussions of fluid dynamics. I am susceptible to memes in English but relatively immune to those in Urdu, because I do not speak that language. Lawyers who practice bankruptcy law are more susceptible than

laypersons to remembering and being affected by discussions of recent bankruptcy decisions.

Taking the metaphor of disease one step further, we can describe a continuum between two types of cultural infections, the endemic and the epidemic. Some cultural software is transmitted persistently over generations of individuals and through many different human cultures; it is endemic to a particular culture or to human thought generally. Other forms of cultural software spread rapidly from person to person, like advertising slogans and fashions. These memes are comparable to epidemics.⁵⁰

The distinction between epidemic and endemic cultural software is quite important for the study of ideology. Many of the cognitive mechanisms that produce ideological effects in human thought are endemic rather than epidemic. Narratives, networks of association, metaphors, and metonymic models are transmitted widely and persistently. Moreover, once in place, these endemic forms of cultural software provide the environment in which epidemic cognitive structures and beliefs can thrive. The study of ideology is the study both of endemic cognitive structures and of epidemic changes in beliefs and symbols.

Racist thought can be both endemic and epidemic. Racist thinking occasionally sweeps from person to person like a dangerous virus. Yet equally important to understanding the phenomenon of racism are more basic cognitive structures—for example, historical associations of white and black with contrasting positive and negative stereotypes. These networks of association are endemic—they are deeply embedded and widely reproduced in many cultures. They prepare the ground for the development and spread of racist beliefs.

Memes as Symbionts

The account of cultural evolution that I have been developing suggests that not only do people have ideas, but ideas have people. Memes “use” people for the purpose of their own propagation. We should not understand such anthropomorphic language literally: memes no more than genes have wants, desires, purposes, or interests. Rather, this is merely a shorthand way of describing how natural selection works on units of cultural transmission.

This approach removes the need to explain human cultural development and proliferation solely in terms of its survival advantages for human beings. To the contrary, we may assume that much cultural development is largely irrelevant to human survival in the short term, although it may have many profound and unexpected long-term effects. Memes do not necessarily reproduce and propagate because this process confers an evolutionary advantage on human beings (although this may in fact occur). Rather, they survive, reproduce, and propagate because it advantages them.

Thus, we can think about cultural software as a kind of symbiont. A symbiont is an organism that lives inside or attached to another organism. The latter organism is called the host, the symbiont is called the guest. We can think of cultural software as a kind of informational symbiont. Under this analogy, our bodies (and our brains) are the biological hosts for cultural software.

Roughly speaking, we can divide symbiosis into three kinds. In the first case, mutualism, the host and guest enhance each other's reproductive fitness. A second case, commensalism, occurs when the symbiosis benefits the guest's reproductive fitness with little or no cost to the host. The third and most familiar case is parasitism. A parasite is a guest that benefits at the expense of the reproductive fitness of the host.⁵¹ The natural world does not divide up as neatly as these categories would suggest. It is quite possible for a guest to help the host in some ways, harm it in others, and be neutral in still others.

Memes are like symbionts that alter the behavior of their hosts, much as the rabies virus alters the behavior of a dog by making it more aggressive, increasing its salivation, and preventing it from swallowing.⁵² Just as the genes in the rabies virus make use of the host to spread their genetic information, memes use their hosts to spread their own memetic information. The rabies virus is a parasite because it increases its own reproductive success at the expense of the dog's. However, the survival and spread of memes can either be advantageous, indifferent, or in opposition to the reproductive fitness of the host—memes can be mutualist, commensalist, or parasitic.

There are two important limitations to the comparison between memes and biological symbionts. First, the union of biological capabilities and cultural software creates a new kind of entity, a person. This is not true in the case of a dog infected with a rabies virus. It is still a dog. Second, this new entity, the person, has new interests independent of the reproductive success of the biological host. People have interests in both senses of that word: there are things that they are interested in (that is, they have preferences, desires, and values) and things that are in their interest. These categories can be further divided into long- and short-term interests, and the various kinds of interests can conflict with each other.

Most living things have relatively uncomplicated interests in eating, surviving, and reproducing. Because people combine genes and memes, their existence is more complicated. Their interests constantly develop, change, and conflict during the course of their lives, and they often have no idea precisely what they want or exactly what actions they should take. Indeed, we might define a person as an entity that is continually at a loss for what to do.

We must therefore distinguish between what advantages a person's interests (in the various senses of that word) and what advantages the reproductive success of his or her genes. Memes can help one while hurting the other, and vice

versa. They can be parasites with respect to reproductive success but commensals or even mutualists with respect to a person's other interests. Consider a Catholic priest who takes a vow of celibacy. Reading certain books or mastering certain cultural skills that help him keep his vow would not enhance his reproductive success, but it might further his other interests.

What complicates matters is that some of people's existing cultural software helps to shape and constitute their interests, and this helps determine what is harmful or helpful. For example, memes that lead a person to watch a lot of television may be mutualist for a person who is a television critic but commensal or even parasitic for a person who is a law student.⁵³ In addition, it is often difficult to separate the interests of memes from the interests of the persons whom they constitute. Consider the question of whether being a television critic is really in my interest. Important features of our personality and important choices in our lives may be the result of the cultural software we possess; they may be inextricably linked to our personal identities and our sense of ourselves.

It is likely that the earliest human memes were predominantly mutualists that enhanced our reproductive success.⁵⁴ They helped human beings (and human genes) do things that helped them survive and reproduce. Primitive systems of communication and cooperation may have been the earliest examples of widely transmitted cultural software among humans. They provided the basic skills necessary for social learning and the spread of culture; and they themselves spread because these skills improved human beings' chances at survival.⁵⁵ The earliest memes probably built on innate skills. Cooperation skills built on whatever instincts for social coordination human beings already had; natural languages built on innate linguistic skills.

But once the first hardy memes took root and spread widely, they prepared the way for other memes that could not previously have infected their human hosts. They created an environment in which new memes could flourish that did not necessarily assist human reproductive success, or that even undermined it. In this way, memes, which originally gained a foothold in human minds as a way of increasing genetic fitness, took on a life of their own. They created new structures for processing information, and thus new susceptibilities for infection by ever more exotic forms of memes, including many commensals and parasites. The new cultural environment in turn created new human interests and hence the possibility of ever new forms of mutualists, commensals, and parasites. As a result, the cultural world we inhabit today contains all three kinds of cultural symbionts.

To be sure, memes are at a severe competitive disadvantage if they routinely threaten the survival of their human carriers; an example would be a belief in the necessity of suicide.⁵⁶ At first one might think this to be true of beliefs that

encourage violent confrontations, war, and murder. But as long as a meme can propagate and reproduce fast enough in enough human beings, the destruction of large numbers of belief carriers is not necessarily fatal to the meme's continued survival. Indeed, to the extent that violence reinforces the violent or aggressive beliefs of the surviving human carriers—for example, by confirming that hatred of the other is justified and that only strength can ensure safety—this may even have a salutary effect on the propagation and survival of violent or aggressive belief.⁵⁷ (Compare the rabies virus, which eventually kills the dog but in the process spreads itself by promoting aggressive behavior.) A similar point applies to the many different cultural skills involved in warfare and destruction. As long as the skills involved in killing people do not completely exterminate the earth's population, these skills will find a welcome home in human minds and propagate accordingly.

The complicated relationship between the interests of memes and their human carriers has a partial analogy in biological evolution. Darwinian processes of natural selection can simultaneously occur at several different levels, with the result that they “leak” into each other or have feedback effects on each other.⁵⁸ That is because an entity that is the object of natural selection within a particular environment can also itself be the environment in which another Darwinian process occurs. Human beings are objects of natural selection in their environment, but human bodies and human cells are also environments where lower-level processes of natural selection can occur. Human cells use DNA for replication, but only a small percentage of human DNA actually is involved in providing the necessary codes for constructing proteins. Much of the rest contains sequences randomly dispersed and repeated over and over again, with no apparent function.⁵⁹ Although some of this DNA may indeed have beneficial effects, the best explanation for it lies elsewhere. Simply put, this DNA has found a way to make copies of itself within the “environment” of human cells and does so because of a familiar Darwinian logic: DNA that does not reproduce itself in this way, or does so less efficiently, will, over time, be increasingly less represented in human cells.

Nevertheless, the human body can be adversely affected by the proliferation of these unnecessary copies in human chromosomes. If this repetitious DNA were to completely take over human cells, it would kill them or so exhaust their energies that it would cause a significant disadvantage for the survival of its environment, the human body, and thus pose a significant threat to its own survival.⁶⁰ On the other hand, if the replication of redundant DNA does not significantly damage or otherwise reduce the survival and reproduction of human bodies, then it will not be weeded out by the higher-level Darwinian process. Hence, redundant DNA acts as a sort of “intelligent parasite,” multiplying as much as it can, but not so much that it kills the goose that lays the

golden eggs.⁶¹ Thus, there is a sort of feedback effect between the two different levels, an interaction between two Darwinian processes. The lower-level units of selection have an interest, albeit an attenuated and imprecise one, in the survival and propagation of the higher-level units of selection that constitute their environment.

No doubt a similar feedback between the survival interests of human beings and memes is also at work in cultural evolution. As long as memetic evolution has no immediate disadvantage for human survival, it is free to develop in many different directions, with unpredictable long-term effects for the human carriers of culture. Moreover, for those who are suitably paranoid, there may even come a time when computers and robots do the jobs of propagating information and reproducing themselves so efficiently that human survival becomes largely irrelevant to memes. At that point we may well have designed ourselves into oblivion.

The inevitable spread of parasitic and commensal memes undermines the strongest sociobiological claims that human culture is the faithful servant of human reproductive success. A complicated process of feedback between genes and memes is more plausible. Lumsden and Wilson argue that genes are largely in control of memes; they claim that “genetic natural selection operates in such a way as to keep culture on a leash.”⁶² This is an unintentionally apt metaphor. As most dog owners quickly learn, it is sometimes difficult to tell who is dragging whom around.⁶³

If parasitic memes arise, why doesn't the human body evolve to avoid them? In the biological world, organisms do evolve to resist parasites. Hosts that are easily infected by parasites may tend to produce fewer offspring, so over time natural selection favors hosts that develop ways of preventing infection. But natural selection also creates pressures on parasites to increase their abilities to infect and replicate.⁶⁴ The result is a sort of arms race in which parasite and host attempt to develop newer and more effective measures to produce and prevent infection, respectively.⁶⁵ If parasites can evolve faster than their hosts, natural selection enables them to adapt to their hosts' defenses more quickly than the hosts can adapt to create new ones. Parasites that go through many generations in a relatively short period of time (like bacteria or viruses) are more likely to win an arms race because natural selection works faster on them.⁶⁶

Of course, hosts have other ways of dealing with parasites. They can create incentives for parasites to develop into commensals or mutualists, for example, by developing a more hospitable environment for variants less harmful to the host. They can even modify their own characteristics so that their guests are less harmful to them. And, as we have seen, there are also evolutionary pressures on parasites to rein in their harmful effects. If a parasite is too virulent

it will destroy its host too quickly and lessen its chances for future transmission to new hosts.⁶⁷ So pressures to increase infection rates compete with pressures to become less harmful to the host—at least before the parasite has transmitted its genes.

Memes are constantly mutating and recombining; they evolve much faster than human genes can. Thus they would almost always win an arms race with the human body. But there is an important difference between the biological and cultural worlds. Memes are usually transmitted to people already constituted by many existing memes and meme complexes. Indeed, most memetic infection is possible only because human minds are already infested with other memes—for example, linguistic skills. So parasitic memes do not simply invade an unaided human host; they compete against an army of cultural software that can adapt more quickly than human genes.

Thus human beings develop memetic filters to ward off potential cultural parasites. Education, for example, can enable us to discriminate between useful and harmful ideas and to ward off bad influences; we can use our powers of reason to overcome our prejudices and persuade others to do likewise. Our cultural software is a bit like an immune system, which attempts to weed out virulent infections. Sometimes the immune system does not recognize the invader as a danger, sometimes it is overtaxed by the infection, and sometimes it overreacts to a harmless invader, as in the case of allergies.⁶⁸ Like immune systems, our cultural software will never have perfect information—it will always engage in rules of thumb, encouraging infection by those memes most likely to be beneficial and blocking or neutralizing those that might be harmful.

All of these defense mechanisms have an interesting effect: they fundamentally change the nature of the organism being defended. People ward off some memes by incorporating others. In the process, they become cultural beings, interested no longer simply in the reproduction of their genetic information but also in the promulgation and protection of their beliefs, values, and skills. Human beings resist culture only by allowing themselves to be conquered by it.

If our memes do affect our behavior, one of the most important ways is by promoting their own propagation. Space in the minds of human beings is limited. So is the time needed to read the books, listen to the music, and learn the motor skills involved in successful cultural transmission. There is not only extensive competition among memes for space in the minds of prospective hosts, but also competition within any existing host for behavior devoted to propagation.⁶⁹ Thus, some (but not all) of our behavior can be seen as the demands for the reproduction of our various memes, just as some (but not all) of our behavior can be seen as responding to demands for the reproduction of our genes.

Many forms of human behavior seem consistent with this hypothesis. Parents not only want their children to survive; they want to pass along their culture and religious beliefs to their children as well. Parents do not want this merely because they believe that these skills and beliefs will enhance their children's future reproductive success; they also want to perpetuate their own religious and cultural beliefs. People can thus be cultural parents as well as biological parents, and bonds of cultural transmission (as in adoptive or foster parenting) can often be strong indeed. Biological parents whose children are raised by others may feel a sense of loss for many reasons, but surely one is the failure to pass along their values and beliefs.

People transmit cultural software not only through the family but also through education. Teachers and mentors can sometimes have quasi-parental interests in the success of their students and protégés, their intellectual offspring. Academics sometimes fight heatedly about hiring and tenure decisions because they want to ensure that people with similar disciplinary commitments succeed them.

Most important, people often seem to have a deep interest in propagation of cultural beliefs to total strangers, as is demonstrated by religious proselytization. If culture were simply a domesticated pet on Lumsden and Wilson's genetic leash, we would expect that people would pass their most treasured memes only to their relatives, as a sort of "family secret" that would benefit future reproductive success.⁷⁰ In fact, we see quite the opposite phenomenon. People are often very interested in the propagation of their cultural software in perfect strangers, whose minds they view as fertile ground for the spread of memes.

This motivation is partly explained by the benefits that come from social coordination. I may have interests, for example, in ensuring that everyone speaks the same language and drives on the same side of the road as I do. But much of our discomfort with cultural differences cannot be explained in this way. Much proselytization cannot simply be seen as a desire to solve collective action problems. There are real advantages to being in the cultural majority, but they stem from the fact that majorities tend to take care of their own common interests, usually to the detriment of cultural minorities.

Altruistic behavior between people who share similar cultural software and oppression or neglect of those with different cultural software would make sense if one goal of human behavior were to propagate memes. Evolutionary biologists argue that competition between genes sometimes leads to cooperative behavior between individuals that maximizes the reproductive success of their commonly held genes.⁷¹ We might expect to see the same thing in the world of culture. Religious groups, academic disciplines, and political parties may help spread and preserve memes more efficiently than individual action.⁷²

The flip side of ideological and religious conflicts, after all, is relative agreement and cooperation within each of the warring sides.

Just as individuals have varying degrees of genetic kinship, they also have varying degrees of memetic kinship.⁷³ The two forms of kinship are cross-cutting: people can have many of the same memes even if they are completely unrelated. If the analogy to evolutionary arguments about kin-based altruism holds, then we would predict considerable altruistic behavior between people with lots of similar cultural software—for example, people of the same religion or culture, teachers and students, members of the same fraternity or club. Of course, just as in the case of genetic explanations of altruism, not all altruistic behavior can or should be explained in this way.

We often see people energetically promulgating their memes in the forms of beliefs, behaviors, artifacts, and customs while struggling with others who resist or disagree. Just as competition between biological kin groups can lead to strife, so can competition between cultural kin groups. The history of humanity is littered with religious wars, ideological conflicts, and partisan disputes, many of which cross lines of genetic kinship.⁷⁴ Within the tiny world of the academy, participants jealously guard their turf and promote their own disciplines and approaches, often with a violence seemingly out of proportion to the importance of the struggle. It is often said that such conflicts are so bitter because so little is at stake. From the standpoint of cultural evolution, however, one might say that a great deal is at stake: control over the reproduction of cultural software. If memes are programmed to survive and reproduce, such struggles are serious business, at least for them. *Kulturkampf*—or cultural struggles—can be seen quite literally as competition between different meme complexes struggling for mastery and survival, using their human carriers as the means of carrying out this struggle. We can even give a memetic spin to the Gramscian idea of hegemony. Cultural hegemony, we might say, is control over the means of memetic reproduction.

Memes in Conventions and Institutions

Memes are the building blocks of institutions and conventions. As ongoing practices of understanding and behavior, institutions and conventions produce new memes. But more important, they also reproduce the memes necessary to make them ongoing practices of understanding and behavior. Institutions and conventions involve meme-making memes—they coordinate memes to reproduce themselves.

Take, for example, the institution of a club or a lodge.⁷⁵ The institution of a lodge usually involves memes for common practices or rituals that distinguish its members, memes for behaving altruistically toward other members, and

memes for gaining new members to continue the practices and rituals of the lodge. If these memes are properly adjusted to each other and to their environment, the entire complex of memes will be self-perpetuating. People will continue to join the lodge over many years, and its rituals will be perpetuated in its members.

A second example is an annual lecture.⁷⁶ An annual lecture series involves a series of coordinated skills that produce new memes (the lecture) as well as perpetuating the skills necessary to perpetuate the institution. Put another way, one has to know how to put on an annual lecture series, and this coordinated body of cultural know-how by various people constitutes the institution. The selection committee chooses a speaker every year, the treasurer raises funds, the publicity committee issues invitations to the guests, the guests show up and sit in the audience, the chair introduces the speaker, and the speaker prepares a set of remarks and gives the lecture. Through the coordination of these various skills, new memes are distributed (those in the lecture and in the brochures, for example), but more important, expectations are created for the perpetuation of the lecture series in the following year.

In both of these examples, the meme-making institutions and conventions depend on a delicate ecological balance that requires coordination between cultural skills and adaptation to the social environment. If parts of the coordinated understandings and actions fail to occur, or if they misfire, the institution can come grinding to a halt; it will fail to produce new memes, in particular the memes that ensure its reproduction. The lodge may be too picky in its membership requirements, for example, or the treasurer may fail to raise sufficient funds for next year's lecture. If the environment in which the memes perpetuate changes too much, the institution may find itself unable to reproduce. Thus a lecture series may fail to gain an audience because of other forms of entertainment, such as television or movies. Conversely, over time, the memes produced by the institution may change. A lodge that began as a social club may turn into a charitable organization, a lecture series that began as a popular exposition of recent scientific discoveries may become a more serious academic event. Many ancient institutions are able to change their rituals, practices, and beliefs in significant ways and yet retain their self-perpetuating character. Such a task is no small feat, for if the complex of coordinated memes changes too much or too quickly, it may disturb the equilibrium of cooperation that assures its continued reproduction. Yet significant transformations do occur, especially over long periods of time. The older versions of the institution are linked to the present one less by clear resemblance than by a line of memetic descent.

Conventions and institutions can change over time, but they also resist change. An important part of cultural conventions and institutions involves ex-

pectations about how other people will behave.⁷⁷ These expectations not only help coordinate behavior, they also stabilize and police it. Some degree of creativity and variance is always possible within conventions and institutions, but too great a variance defeats expectations, threatens stability, and endangers cultural reproduction. Hence great change produces resistance. Of course, strong resistance to interferences with successful reproduction is precisely what we would expect from self-reproducing entities that emerge from natural selection.

Some rational-choice theorists have tried to explain social conventions and institutions as coordinated behaviors of rational actors that are able to surmount collective-action problems.⁷⁸ An example of such a problem is a prisoner's dilemma, in which fear of loss from defection by others tempts parties to defect from coordinated action that might benefit them all. Rational-choice theorists have tried to show how such coordinated behaviors might arise spontaneously. The theory of cultural software approaches this problem from a slightly different perspective. Instead of focusing on how rational behavior of human beings might overcome collective-action problems, it focuses on the collective-action problem faced by memes themselves. We can make an analogy once again to genes that cooperate with each other to create multicelled organisms, thereby enhancing their joint survival chances. Conventions and institutions are coordinated complexes of meme-making memes. They cooperate with each other because this cooperation enhances their joint reproductive success. By assisting in each other's reproduction, each meme helps the other gain precious space in human minds and bodily behaviors.

Conventions and institutions reproduce expectations in people about how others will behave. These expectations are essential parts of self-reproduction. They are important because they let conventions and institutions "turn the tables" on the problem of collective action. Once cultural expectations are in place and continually reproduced in human minds, it takes collective effort for variant memes to overcome the settled body of cultural expectations.

Why switch our focus from the rational actor to the unit of cultural transmission? I noted earlier that memes can be mutualist, commensal, or parasitic with respect to their human hosts. Because commensal and even parasitic memes are an almost inevitable development in cultural evolution, we cannot assume that all conventions and institutions are merely solutions to coordination problems that benefit human hosts, either in terms of their reproductive success or their interests as rational actors. Some conventions and institutions may be commensals, and some may actually be quite harmful.

The history of human culture is the history of human susceptibility to various kinds of memes. As people are infected, their memes prepare the way for new memes, that, in the process, alter and even increase human suscepti-

bility to memes. Consider, for example, the types of memetic infections made possible by learning a human language. These new susceptibilities are passed along from generation to generation in the form of human culture. At some point in human history, human beings became susceptible to a variety of conventions and institutions. They became fertile ground for any number of self-reproducing complexes of memes. This development may originally have been a good one from the standpoint of human reproductive success. But it made human beings susceptible to infection from many different kinds of conventions that did not necessarily have the best interests of humanity at heart. Of course, internalized memes do not merely weaken human immunity to new invasions of memes. They also create a new “immune system” that can ward off some harmful memes. However, this cultural immune system cannot perfectly distinguish between memes that are useful in the long run and those that are not.

Social conventions and institutions are possible because our brains developed so that they were fertile soil for certain types of self-perpetuating skills. But once this fertile ground was created, it became suitable for many different kinds of conventions that might be created in the future, just as fertile soil can admit weeds as well as useful plants. So we cannot assume that all conventions are beneficial to the members who engage in them. Some conventions (for example, slavery) are indeed “solutions” to social coordination problems, but they are not necessarily beneficial solutions. Other conventions, like the meanings of certain fashion designs, are commensal, in that they have very little benefit.

Shifting our attention from the interests of rational actors to the “interests” of conventions and institutions themselves—as collections of self-reproducing memes—puts a very different spin on the growth and development of human culture. It allows us to understand evolutionary developments without having to explain them in functionalist terms or in terms of rational benefit to humanity. We need no longer conjure up “just-so” stories to explain all of the various features of human culture. Instead, we can understand human culture as a compromise and conflict between the interests of persons, their genes, and their memes. We can make better sense of the idea of conventions or institutions that literally take on a life of their own, regardless of their current or long-term benefit to humanity.

This evolutionary approach to conventions has a further advantage. Dawkins’s original formulation of memes was an extension of his theory of “selfish genes,” which argued that genes used organisms to maximize their own reproductive success. Naturalists like Stephen Jay Gould and Richard Lewontin have countered that too exclusive a focus on the gene fails to reckon with the constraining force of the architecture of organisms.⁷⁹ Gould and Lewontin’s attack on the “adaptationist program” reminds us that “organisms are not so much

paragons of design as compromises of design.”⁸⁰ Natural selection cannot always perfectly hone organisms to maximal reproductive success in their ecological niches. Organisms may lack the necessary genetic variation for natural selection to do its work. Previous design choices may limit future innovations, allowing only bricolage rather than bottom-up design.

A similar point applies to the complexes of memes we find in conventions and institutions: they too are compromises of design. Only some changes are possible if conventions and institutions are to maintain their self-reproducing character. And, like species, they also face “architectural” constraints. They can only change in certain ways, given their previous history and the cultural means at hand. Hence, conventions and institutions produced through cultural evolution are highly unlikely to perfectly optimize any external standards of design in their current environment, whether that standard be social functionality, moral efficacy, or economic efficiency.⁸¹ Indeed, the imperfections and the jerry-built character of conventions and institutions are the best evidence of their historical development. This realization connects the theory of memetic evolution with my discussion of cultural bricolage in Chapter 2.

We cannot always infer the current utility of a feature of a convention or institution from its current existence. And we cannot infer from a feature’s current utility the reasons for its origin. Rather, we are likely to see, in Gould’s phrase, “panda’s thumbs” in both conventions and institutions. Cultural developments of social conventions and institutions are likely to be extapations, in which memes adapt old features to new uses in a changed environment. Features of existing conventions and institutions may often have arisen for one reason, but now serve very different functions and purposes.

The argument I have just presented synthesizes Dawkins’s concept of memes with Gould’s theory of architectural constraint. The concept of memes was originally coined by Dawkins, whose views about adaptation have been criticized by Gould. But once we take into account the role of meme complexes in cultural evolution, and the need for these complexes to reproduce together in a given ecology, we see that Gould’s point about evolutionary bricolage applies with equal force to models of cultural evolution. And this requires us to modify Dawkins’s original conception of memetic evolution.

Indeed, there is something entirely fitting in bringing these two seemingly disparate strands of evolutionary theory together. The original inspiration for Gould and Lewontin’s theory of evolutionary bricolage was an example drawn from the world of culture—the spandrels in the Basilica of San Marco. Spandrels are triangular spaces created when one places a cathedral dome on top of four rounded archways set at right angles to each other. Artists made use of these spaces to place elaborate mosaics and other decorations. Gould and Lewontin pointed out that it would be fallacious to assume that the basilica was

designed to produce the decorative spandrels; rather the custom of decorating the spandrels is simply an ingenious use of spaces that necessarily resulted from previous limitations on the design of cathedrals.⁸² In the same way, if we wish to study the development of cultural software, we must not assume that all features of human thought and practice are currently or perfectly adaptive to memetic survival. Rather, we must patiently investigate the ways in which layers of memetic innovation occur given the existing constraints of human thought and human cultural conventions.

3. Memetic Evolution

1. Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, new ed., 1989), 192.

2. See Daniel C. Dennett, *Consciousness Explained* (Boston: Little, Brown, 1991), 200; Dawkins, *The Selfish Gene*, 322.

3. Graham Cairns-Smith, *Genetic Takeover and the Mineral Origins of Life* (Cambridge: Cambridge University Press, 1982); Graham Cairns-Smith, *Seven Clues to the Origin of Life: A Scientific Detective Story* (Cambridge: Cambridge University Press, 1985).

4. Dawkins, *The Selfish Gene*, 192.

5. Robert Boyd and Peter J. Richerson, “The Evolution of Norms: An Anthropological View,” *Journal of Institutional and Theoretical Economics* 150, no. 1 (1994): 72–87, at 74; Robert Boyd and Peter J. Richerson, *Culture and the Evolutionary Process* (Chicago: University of Chicago Press, 1985).

6. See, e.g., Daniel C. Dennett, *Darwin’s Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon and Schuster, 1995), 344; Henry C. Plotkin, *Darwin Machines and the Nature of Knowledge* (Cambridge: Harvard University Press, 1994), 215; Richard Brodie, *Virus of the Mind: The New Science of the Meme* (Seattle: Integral, 1996); Aaron Lynch, *Thought Contagion: How Belief Spreads Through Society* (New York: Basic, 1996). By contrast, I argue that the most basic forms of memes and meme complexes are skills.

7. Thus the different uses of cultural tools offered in Chapter 2 can all be redescribed as different aspects of cultural know-how. Knowing how to get about in the world, how to deal with others, and how to articulate one’s values all can be and are transmitted in the form of memes.

8. In terms of our computer metaphor, the primacy of knowing how over knowing that tends to blur the distinction between information (data) and code (instructions). Yet this distinction is already blurred when we define memes as units of cultural transmission. If memes are to be transmitted to others, and thus become cultural, they must have some observable effects on human behavior—at the very least enough so that they are in fact transmitted. See John A. Ball, “Memes as Replicators,” *Ethology and Sociobiology* 5 (1984): 145–61, at 154.

9. Dan Sperber, *Explaining Culture: A Naturalistic Approach* (Oxford: Blackwell 1996), 24.

10. Dennett, *Darwin’s Dangerous Idea*, 353.

11. *Ibid.*, 354.

12. Dan Sperber and Deirdre Wilson, *Relevance: Communication and Cognition* (Oxford: Blackwell, 1986).

13. Human beings communicate meanings to others by many devices, including signs, words, dress, and behavior. Human action is always freighted with meaning and as a result it often communicates in addition to whatever else it does. Hence we cannot restrict the notion of memetic transmission to action that is intended by the agent to communicate a message. Conversely, there is no guarantee that individuals will receive what others have deliberately sent them. Students do not always learn exactly what a teacher hopes that they will learn. They may misunderstand the teacher’s lesson, learn

only parts of it, or learn nothing at all. Their ability to assimilate new information, or new ways of thinking, depends upon the cultural software they already possess. Thus it is not surprising that two persons who attend the same lesson will carry different things away from it. Their cultural software affects how each will assimilate or reject, understand or miss the point of what is being said; the cultural software of each affects how that software will change in response to what each experiences.

Our tools of understanding are also affected by interactions that are not intended to teach us anything at all. An elementary school teacher may be attempting to demonstrate how to multiply fractions, but what her pupils may be learning from her is how to dress, how to speak, and how to behave in public. If she calls on boys to solve math problems more frequently than girls, or interrupts girls more frequently than boys, they may be learning cultural lessons that the teacher may not intend for them to learn at all. The process of communicative interaction is complex and unpredictable. We therefore cannot predict how people's cultural software will be affected simply by examining what an agent intended to convey or the content of what she said. There is always a possible divergence between intended communication and effects on cultural software. Indeed, there is always the possibility that communication will have no significant effects at all.

14. Dennett, *Consciousness Explained*, 201; see Dawkins, *The Selfish Gene*, 195.

15. Dennett, *Darwin's Dangerous Idea*, 344.

16. In the key of D, the notes are f#-e'-d'-b-a-f#-a-d'-b-a.

17. This is because, as a practical matter, these three notes do not invoke the larger melody Tchaikovsky wrote, or the symphony as a whole, unlike, for example, the first four notes of Beethoven's Fifth Symphony. Because reproducibility and memorizability depend on environmental factors, however, there is no reason in theory why Tchaikovsky's notes could not someday be a meme.

To return to Dennett's original example, the notes D-F#-A are the notes of a major triad, one of the building blocks of Western music. (More precisely, they are the notes of the D-major triad. This raises the interesting question of whether transpositions of melodies in different keys constitute the same meme or different memes.) These notes are reproduced continuously and reliably precisely because they are an enjoyable and satisfying combination of elements to Western ears. They are, in Dennett's words, "distinct memorable units" that music students are taught to memorize and employ in compositions. *Ibid.*, 344. Thus they are both memes in their own right and the building blocks of other memes.

18. The U.S. Copyright Office Regulations specifically state that short phrases cannot be copyrighted. See 37 C.F.R. sec. 202.1(a) (1994) (excluding from copyright protection "words and short phrases such as names, titles, and slogans" and "familiar symbols and designs"). One reason often given for the rule is that ordinarily, short phrases do not display the creativity sufficient to justify enforcement of what is in effect a property right in their use. See, e.g., *Magic Marketing, Inc. v. Mailing Services of Pittsburgh, Inc.*, 634 F. Supp. 769, 771 (W.D. Pa. 1986); Jessica Litman, "The Public Domain," *Emory Law Journal* 39 (1990): 965–1023, at 1013–14.

The details of intellectual property law are beyond the scope of this book. Suffice it to say that many different kinds of units, from phrases to font shapes, from techniques

to trade names, can and have been given intellectual property status under copyright, patent, or trademark laws. The layperson will likely be amazed both at the insignificance of many things that have been given intellectual property status and at the significance of many things that have been denied this status. Thus, although the statement made in the text is broadly true, it is subject to many qualifications and complications, due in part to the idiosyncracies of legislative drafting, litigation strategy, and judicial enforcement.

19. Ernst Mayr, *The Growth of Biological Thought* (Cambridge: Harvard University Press, 1982), 46–47.

20. Dan Sperber, “Anthropology and Psychology: Towards an Epidemiology of Representations,” *Man* n.s. 20 (1985): 73–89, at 74.

21. Sanford Levinson and J. M. Balkin, “Law, Music, and Other Performing Arts,” *University of Pennsylvania Law Review* 139 (1991): 1597–1658, at 1623.

22. Juan Delius, “The Nature of Culture,” in *The Timbergen Legacy*, M. S. Dawkins, T. R. Halliday, and R. Dawkins, eds. (London: Chapman and Hall, 1991), 71–99, at 81. As Delius points out, “Culture as a persistent phenomenon is heavily dependent on long-term memories.”

23. Dennett, *Darwin’s Dangerous Idea*, 348–49.

24. See Dawkins, *The Selfish Gene*, 199.

25. This feature of cultural transmission underlies the deconstructive theory of the sign. The public nature of communication requires that signs be able to signify repeatedly to new users and in new contexts regardless of the intentions that originally created them. This ability of signs to be detached from the author’s private intentions, and to mean something other than what the author meant, makes iterability, and hence inter-subjective meaning, possible. See J. M. Balkin, “Deconstructive Practice and Legal Theory,” *Yale Law Journal* 96 (1987): 743–86, at 779–81. As a sign is repeatedly understood, it takes on a life of its own in a relation of partial similarity and partial difference from the person who meant it. Repetition of a sign in a new context is simultaneously a relation of identity and difference; the repeated sign is syntactically identical, yet semantically different. Hence the deconstructive aphorism that “iterability alters.” Jacques Derrida, “Limited Inc abc . . .,” *Glyph* 2 (1977): 162–254, at 200.

26. Dennett, *Darwin’s Dangerous Idea*, 353–56.

27. See Jon Elster, *Sour Grapes: Studies in the Subversion of Rationality* (Cambridge: Cambridge University Press, 1983), 152–53.

28. See the discussion of cognitive dissonance theory in Chapter 8.

29. Charles Darwin, *On the Origin of Species by Means of Natural Selection*, in *The Portable Darwin*, Duncan M. Porter and Peter W. Graham, eds. (New York: Penguin, 1993), 185; Niles Eldredge, *Reinventing Darwin: The Great Debate at the High Table of Evolutionary Theory* (New York: Wiley, 1995), 50.

30. James Burke, *Connections* (Boston: Little, Brown, 1978), 108–13. This book, based on the television series of the 1970s, contains many wonderful examples of technological borrowing.

31. See Stephen Jay Gould, “The Panda’s Thumb of Technology,” in *Bully for Brontosaurus* (New York: Norton, 1991), 59–75, at 65. The ability of memes to combine

in human minds means that cladistics—the study of lineages—is extremely difficult in the case of memes. Yet it is an important element in the study of biological evolution. Eldredge, *Reinventing Darwin*, 53–55. One might think of intellectual history as a sort of cladistics of memes. Intellectual historians often try to study ideas as they change through history, but the theory of memes suggests why this enterprise presents so many complications.

32. Dan Sperber calls this an “attraction model” of cultural evolution because the transformation of cultural software (or cultural representations, as he calls them) tends to converge toward the most popular versions, or “attractors.” The term *attractor* is borrowed from chaos theory. An attractor attracts nothing; it is simply the standard set of features toward which successive transformations tend, on the average, to move. Once near an attractor, subsequent transformations tend to stay in the general vicinity. Sperber notes that the reasons why transformations converge on attractor points may depend on universal features of human psychology or the vicissitudes of the local cultural environment. Changes in the cultural environment may shift cultural attractor points and lead to large-scale shifts in belief and practice. Sperber, *Explaining Culture*, 105–18.

Sperber contrasts his attraction model to the evolutionary theories of Dawkins and Dennett, which focus on the survival of memes in individual minds rather than on their successive transformation. He also rejects the use of the word *meme* because he assumes that memetic evolution necessarily presupposes virtually exact copying of cultural information, employing human beings as mere “agents of replication . . . with little or no individual contribution to the process” (105–6). This strikes me as a bit of a caricature. A Darwinian theory of cultural evolution is in no sense committed to this position. Sperber is engaged in a play on words, identifying the word *meme* with its French cognate (*même*, meaning same or identical) rather than focusing on its connection with memory. Memories of events surely change as they are transmitted from person to person; memory is rarely, if ever, *la même chose*.

There is no reason why the use of the term *meme* has to be tied to the fallacious assumption that cultural transmission is a matter of perfect copying. Theories of cultural evolution should be based on the recognition that although sometimes replication of cultural information is fairly exact, more often it is not. Scribes may carefully copy manuscripts, but musical performers improvise. Xerox machines duplicate, but cooks change proportions and add new ingredients. Indeed, symbolic forms that exist outside human minds are much more likely to be exact copies of each other than the cultural software in human minds. That is because human technology can create exact copies, while the processes of human memorization and understanding rarely do.

Whatever we call the units of cultural transmission, whether memes, representations, or something else, a theory of cultural evolution must reckon with both differential rates of attractiveness to other minds and distinctive forms of transformation by the minds who possess them. This is Sperber’s deeper point. Cultural evolution must be shaped not only by those factors that ensure the survival of descendants but by those factors that ensure that the descendants remain roughly similar to each other.

33. See Dennett, *Consciousness Explained*, 204; Donald Campbell, “Comments on the Sociobiology of Ethics and Moralizing,” *Behavioral Science* 24 (1979): 37–45.

34. Dennett, *Darwin's Dangerous Idea*, 348. As Dennett points out, "Plato's ideas survive not because of the survival of individual papyrus manuscripts, but because they were continuously copied."

35. See Donald R. Griffin, *Animal Minds* (Chicago: University of Chicago Press, 1992); John Tyler Bonner, *The Evolution of Culture in Animals* (Princeton: Princeton University Press, 1980); Merlin Donald, *Origins of the Modern Mind: Three Stages in the Evolution of Culture and Cognition* (Cambridge: Harvard University Press, 1991).

36. Thus birdsongs are a kind of meme that can survive in the environment that bird's minds and bodies provide. See Dawkins, *The Selfish Gene*, 189–90.

37. Dennett, *Consciousness Explained*, 202.

38. *Ibid.*, 202, 206.

39. See Dennett, *Consciousness Explained*, 218.

40. *Ibid.*, 220.

41. *Ibid.*

42. Dennett, *Darwin's Dangerous Idea*, 350.

43. Richard Nisbett and Lee Ross, *Human Inference: Strategies and Shortcomings of Social Judgment* (Englewood Cliffs, N.J.: Prentice-Hall, 1980), 169–88.

44. See the discussion in Chapter 8.

45. Dennett, *Darwin's Dangerous Idea*, 351.

46. *Ibid.*

47. Sperber, "Anthropology and Psychology," 74. Cavalli-Sforza and Feldman have explicitly attempted to model cultural transmission on the transmission of disease. L. L. Cavalli-Sforza and M. W. Feldman, "Models for Cultural Inheritance," 1, "Group Mean and Within Group Variation," *Theoretical Population Biology* 4 (1973): 42–45; L. L. Cavalli-Sforza and M. W. Feldman, *Cultural Transmission and Evolution: A Quantitative Approach* (Princeton: Princeton University Press, 1981); L. L. Cavalli-Sforza and M. W. Feldman, "Cultural Versus Genetic Adaptation," *Proceedings of the National Academy of Sciences, USA* 80 (1983): 4993–96. Their models also use the idea of genetic drift as an evolutionary mechanism.

Similar models have been proposed for the spread of technological innovation. Everett M. Rogers, *Diffusion of Innovations* (New York: Free Press, 3d ed., 1983). The cumulative adoption of an innovation usually seems to follow an S-shaped curve which resembles the spread of communicable diseases.

48. Sperber, "Anthropology and Psychology," 74. Brodie, *Virus of the Mind*, and Lynch, *Thought Contagion*, are two recent accounts of memetics that are organized around the communicable-disease analogy. Each offers abundant historical and cultural examples.

49. Dennett, *Darwin's Dangerous Idea*, 352.

50. Sperber, "Anthropology and Psychology," 74.

51. Delius, "The Nature of Culture," 84.

52. *Ibid.*, 84–85.

53. *Ibid.*, 86–87.

54. *Ibid.*, 87.

55. Charles J. Lumsden and Edward O. Wilson, *Genes, Mind, and Culture: The Co-evolutionary Process* (Cambridge: Harvard University Press, 1981).

56. Dennett, *Consciousness Explained*, 203; Richard Dawkins, *The Extended Phenotype* (San Francisco: Freeman, 1982), 110–11.

57. Conspiracy theories and beliefs that are linked to prohibitions against exposing one's self to contrary beliefs are also good examples of self-reinforcing beliefs. See Dennett, *Consciousness Explained*, 206; Dawkins, *The Selfish Gene*, 198–99.

58. Stephen Jay Gould, *Hen's Teeth and Horse's Toes* (New York: Norton, 1983), 174–75.

59. *Ibid.*, 167.

60. *Ibid.*, 175.

61. *Ibid.*, 173.

62. Lumsden and Wilson, *Genes, Mind, and Culture*, 13.

63. The fact that so many members of the Catholic clergy have been able to suppress their reproductive urges over so many years is perhaps the best evidence of the power of memes over genes. Even though Catholic clergy occasionally (and predictably) have gone astray, the degree of celibacy that they have been able to practice over the centuries is certainly remarkable.

64. An example is the development of strains of bacteria that are resistant to antibiotics—although this is a response not to human biological evolution but to changes in human technology.

65. George C. Williams and Randolph M. Neese, “The Dawn of Darwinian Medicine,” *Quarterly Review of Biology* 66, no. 1 (March 1991): 1–22, at 7.

66. Delius, “The Nature of Culture,” 86, 91.

67. *Ibid.*, 85.

68. *Ibid.*, 89.

69. *Ibid.*, 93.

70. *Ibid.*, 89–90.

71. See Alexander Rosenberg, “Altruism: Theoretical Contexts,” in *Keywords in Evolutionary Biology*, Evelyn Fox Keller and Elisabeth A. Lloyd, eds. (Cambridge: Harvard University Press, 1992), 19–28.

72. Delius, “The Nature of Culture,” 93–94.

73. *Ibid.*, 94.

74. Because memetic kinship can differ from genetic kinship, sometimes cultural and biological altruism will be reinforcing and sometimes they will be at odds. The bond between parents and children is no doubt strengthened by the cultural transmission that usually accompanies parenting. On the other hand, there are many stories of families split asunder by civil wars and religious disputes.

75. Ball, “Memes as Replicators,” 156.

76. Sperber, “Anthropology and Psychology,” 86.

77. For a helpful discussion see Roger C. Schank, *The Connoisseur's Guide to the Mind: How We Think, How We Learn, and What It Means to Be Intelligent* (New York: Summit, 1991), 35–41.

78. See, e.g., Ken Binmore, *Game Theory and the Social Contract: Playing Fair*, vol. 1 (Cambridge: MIT Press, 1994); Robert Axelrod, *The Evolution of Cooperation* (New York: Basic, 1984); Edna Ullmann-Margalit, *The Emergence of Norms* (Oxford: Clarendon, 1977).

79. Stephen Jay Gould and Richard C. Lewontin, “The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme,” *Proceedings of the Royal Society, London* (1979) B.205: 581–98.

80. Eldredge, *Reinventing Darwin*, p. 46.

81. For examples of this point in the evolution of accident law, see J. M. Balkin: “Too Good to Be True: The Positive Economic Theory of Law,” *Columbia Law Review* 87 (1987): 1447–89.

82. Gould and Lewontin, “The Spandrels of San Marco,” 582–83.

4. The Spread of Cultural Software

1. See John A. Ball, “Memes as Replicators,” *Ethology and Sociobiology* 5 (1984): 145–61.

2. Daniel C. Dennett, *Darwin’s Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon and Schuster, 1995), 349; see also Richard Dawkins, “Viruses of the Mind,” in *Dennett and His Critics*, Bo Dahlbom, ed. (Oxford: Blackwell, 1993), 13–27.

3. Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, new ed., 1989), 212.

4. Dennett, *Darwin’s Dangerous Idea*, 349.

5. *Ibid.*

6. Dan Sperber, “The Epidemiology of Beliefs,” in *The Social Psychological Study of Widespread Beliefs*, Colin Fraser and George Gaskell, eds. (Oxford: Clarendon, 1990), 25–44.

7. Dennett, *Darwin’s Dangerous Idea*, 349.

8. See Dan Sperber, “Anthropology and Psychology: Towards an Epidemiology of Representations,” *Man* n.s. 20 (1985): 73–89, at 82.

9. *Ibid.*, 80–83.

10. Eric A. Havelock, *Preface to Plato* (Cambridge: Harvard University Press, 1963); Albert B. Lord, *The Singer of Tales* (Cambridge: Harvard University Press, 1960).

11. Sperber, “Anthropology and Psychology,” 86. Sperber calls this the “Law of the Epidemiology of Representations” for oral cultures.

12. Neil Postman, *Amusing Ourselves to Death: Public Discourse in the Age of Show Business* (New York: Penguin, 1985); Marshall McLuhan, *Understanding Media: The Extensions of Man* (New York: McGraw-Hill, 1964); Marshall McLuhan, *The Gutenberg Galaxy: The Making of Typographic Man* (Toronto: University of Toronto Press, 1962).

13. Walter J. Ong, *Orality and Literacy: The Technologizing of the Word* (London: Methuen, 1982).

14. Postman, *Amusing Ourselves to Death*; McLuhan, *The Gutenberg Galaxy*; Ong, *Orality and Literacy*, 135–38.