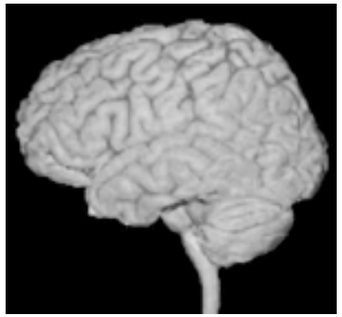
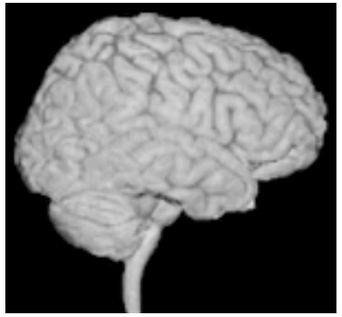
Unlike dummy text, ideas are not to come dummy from one dummy text, ideas are not to come dummy from dummy text"

Sounds are more fecund than gestures, particularly sounds analogous to "hey!" or "look out!" Everyone within earshot can hear a shout, whether they happen to be looking at the speaker or not. Fidelity of spoken memes is higher for those built from discrete phonemes and divided into words—a kind of digitization that reduces errors in copying. As different actions and vocalizations competed in the prehistoric meme pool, such spoken words would prosper and displace less well-adapted memes of communication. Stringing words together in different orders, and adding prefixes and other inflections, provide fertile niches for new, more sophisticated vocal memes. Rough adherence to an internal logic, or grammar, enhances the fidelity of copying of these more elaborate memes. In sum, the highest quality replicable sounds would swamp out the poorer ones.

Now consider the effect on the genes. Once again the best imitators, the most articulate individuals using the hippest language (and having the best collection of clever survival tricks and so on), would acquire higher status, the best mates and the most offspring. Genes for the ability to imitate the winning sounds increase in the gene pool. I suggest that by this process the successful sounds, the foundations of spoken language, gradually drove the genes into creating a brain that was not merely big, but especially adept at copying them. The result was the remarkable human capacity for language, including our brains' apparent hard-wiring for deciphering natural grammar as infants. It was designed by memetic competition and meme-gene co-evolution.

The process of memetic driving is an example of replicators (memes) evolving concurrently with their copying machinery (brains). Something similar must have occurred in the earliest stages of life on earth, when the first replicating molecules developed in the primeval soup and evolved into DNA and all of its associated cellular replication machinery. Unlike imitation in other species, human imitation is clearly good enough (fecundity, longevity and fidelity) to sustain memetic evolution, but there is plenty of room for improvement. So we might expect better copying machinery to have appeared—and it has. Written language provided a vast leap forward in longevity and fidelity; the printing press enhanced fecundity. From the telegraph to the cell phone, from "snail" mail to e-mail, from phonographs to DVDs, and from computers to the Internet, copying machinery has been improving and spreading a growing multitude of memes further and faster. Today's information explosion is just what we should expect of memetic evolution.





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Experimental Tests

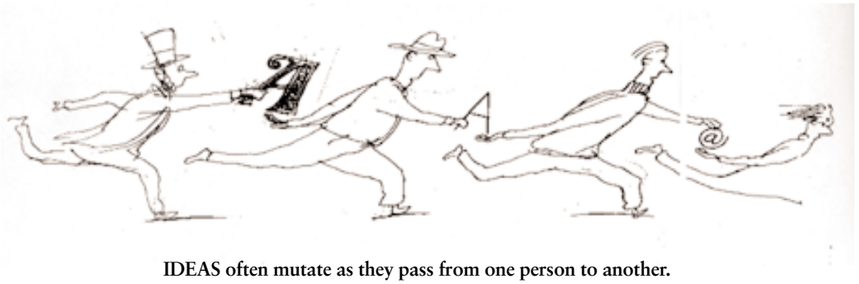
This memetic theory depends on a number of assumptions that can be tested, especially the assumption that imitation requires a lot of brain power, even though it comes so easily to us. Brain scan studies might compare people carrying out actions with others copying them [see illustration brain scans on page 00]. Contrary to common sense, this theory assumes that imitation is the harder part—and also that the evolutionarily newer parts of the brain should be especially implicated in carrying it out.

COUNTERPOINT

Meme Theory Oversimplifies Cultural Change

by Robert Boyd and Peter J. Richerson

Genes are replicators. They pass faithfully from parent to child and control the machinery of life. This faithful transmission is what enables natural selection to operate: genes that cause their bearers to survive better or reproduce faster than bearers of other genes will spread through the population. Other processes, such as mutation, play crucial roles in evolution, but most adaptation can be explained by asking which genes will replicate at the highest rate. This simple rule has astonishing power, allowing biologists to understand phenomena as diverse as the shape of the human pelvis and the timing of sex changes in hermaphroditic fish.



DUSAN PETRICIC

IDEAS often mutate as they pass from one person to another.

Susan Blackmore argues that beliefs and ideas, which she calls memes, are also replicators. They are copied faithfully from one mind to another and control the behavior of the people who acquire them. That being the case, Blackmore suggests, the evolution of ideas is also shaped by natural selection, and cultural change can be understood by asking which memes replicate most quickly.

We think Blackmore is at least half right. Ideas from biology are certainly useful for studying cultural evolution. Culture does consist of ideas stored in a population of human brains, and mechanisms analogous to natural selection can affect which ideas spread and which ones disappear. But Blackmore is probably wrong in thinking that cultural evolution can be explained in terms of natural selection alone. Instead scientists need to combine research from psychology, anthropology and linguistics to clarify the multiple processes that actually shape human culture.

Unlike genes, ideas usually are not passed intact from one person to another. Information in one person's brain generates a behavior, and then someone else tries to infer the information required to do the same thing. Breakdowns in the accurate transmission of ideas can occur because differences in the genes, culture or personal background of two individuals can cause one person to make a wrong assumption about what motivated the other's behavior. As a result, memes are often systematically transformed during transmission—a process quite unlike natural selection, which depends on one meme spreading more quickly than competing alternatives. Transformation, on the other hand, could cause people in one generation to acquire a different meme than the one held by every person in the previous generation.

David Wilkins of the Max Planck Institute for Psycholinguistics in Nijmegen in the Netherlands discovered a simple example of meme transformation when he found that Americans of different generations vary in their understanding of the word ending *-gate*. People over 40 assumed that *–gate* implied a government scandal in Washington, usually involving a cover-up. These baby boomers had experienced Richard Nixon's presidency as adults and interpret constructions such as *Travelgate* as scandals analogous to Watergate. Younger Americans in Wilkins's study had heard *–gate* used to refer to a variety of scandals in Washington. Americans in Wilkins's interpret constructions study had heard *-gate* used to refer to a variety of scandals in Washington. But knowing much less about Watergate, they couldn't detect this common thread and instead analyzed *-gate* as a suffix that can be added to any word to indicate a scandal. Notice that this transformation could have occurred without competition among alternative memes. Every meme in every baby boomer brain could specify that *-gate* means a government scandal like Watergate; nonetheless, every younger person could have inferred *-gate* to mean any scandal.

Memes are often systematically transformed during transmission—a process quite unlike natural selection.

As Blackmore notes, genes can also be transformed by spontaneous changes called mutations. But genetic mutations are rare, occurring about once every million replications, and as a result their effect usually can be ignored when thinking about adaptations. If mutations occurred more often—say, every 10 replications—they would have a significant effect on which genes were most common. We think this situation is exactly what occurs with ideas, which can transform rapidly as they spread from one person to the next. If we are right, cultural change will be understood only if the effects of transformation and natural selection are combined.

A number of other nonselective processes may affect the evolution of ideas. For example, people can learn an idea from others and then innovate, modifying the idea in an effort to improve it. Still other nonselective processes can arise when people synthesize their own beliefs after being exposed to a number of people who behave differently. We think that successful interpretations of cultural change require meticulous attention to the many processes that may guide particular instances of cultural evolution. Social scientists have already made some progress on this project. William Labov of the University of Pennsylvania, has described the psychological and social processes that cause gradual changes in dialect from generation to generation, for instance, and Albert Bandura of Stanford University has studied how imitation shapes the acquisition of ideas.

Over the past century biologists have developed many concepts and mathematical tools that can help clarify what happens when a variety of processes interact to shape the evolution of populations. By combining these ideas with empirical studies, scientists may then be able to may then be able to understand how culture evolves.

ROBERT BOYD and PETER J. RICHERSON have collaborated for 25 years in studying the evolution of human culture and how cultural and genetic evolution interact. Their work couples mathematical models with empirical work drawn from laboratory and field research. Boyd is an evolutionary anthropologist at the University of California, Los Angeles; Richerson is a population biologist at the University of California, Davis.