

Mememes, Communication Technology, & Cultural Change

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Introduction

"The successor to politics will be propaganda. Propaganda, not in the sense of a message or ideology, but as the impact of the whole technology of the times."

-- Marshall McLuhan, Canadian communications theorist.

"All of us who professionally use the mass media are the shapers of society. We can vulgarize that society. We can brutalize it. Or we can help lift it onto a higher level."

-- William Bernbach, American advertising executive.

Communication technologies wield undeniable power over societies. They influence how fast and how far information travels, and they determine which ideas are preserved over time. They are the medium through which cultures spread. Those who control these technologies have the power to mold society in their image. As the reach and speed of telecommunication accelerates into the 21st century, this power will determine the course of cultural evolution.

According to the theory of memetics, human behaviors and ideas ("memes") spread like viruses and evolve through a process of selection, just as biological species do. Cultures can be thought of as populations of interdependent memes, or "meme-plexes," just as DNA strands are populations of interdependent genes. The sum total of all memes in a given community is called its "meme pool." Both memes and genes are shaped by their environment; selection pressures

determine which ones thrive and which fade into extinction.

Inventions like the printing press and the telephone are an important part of the memetic environment. They influence how long memes persist, how quickly they reproduce, and how far they spread. Understanding the relationships between these technologies and the memetic selection pressures they produce will provide valuable insights into human history. It will also help us anticipate the ways in which new technologies will shape the future.

Communication technologies transform societies via their effects on memetic selection. This paper will illustrate these processes by comparing the historical effects of two inventions with very different memetic profiles. The written word ended prehistory by allowing people to record their memes. Radio and television, on the other hand, significantly expanded the reach of memes and the speed with which they spread. Each invention changed the world in distinct and instructive ways.

Finally, the lessons taught by these examples will be used to make some fairly specific predictions regarding the future. The internet possesses many memetic characteristics that have never been combined into a single telecommunications system before. It will apply a new set of selection pressures on the meme pool and give rise to entirely new forms of social life. It may even accelerate the pace of historical and technological change to what futurists would call a "cultural singularity."

Meme Theory

Richard Dawkins popularized the term "meme" when he proposed that the process of natural selection is not specific to the chemical processes of genetic transmission. Rather, he argued that a process of selection logically *must* occur whenever any phenomenon exhibits a set of three characteristics: variability, inheritability of traits, and competition for survival. Such phenomena are called "replicators." Susan Blackmore paraphrases Darwin on the matter...

"He reasoned that if living creatures vary (as they certainly do) and if, due to their geometric increase in numbers, there is at certain times a struggle for life (which cannot be disputed), then it would be most extraordinary if there were not some variation that was useful to a creature's welfare. The individuals with these characteristics will then have the best chance of being 'preserved in the struggle for life' and will produce offspring with the same characteristics. This was the principle he called 'natural selection'" (p. 10).

Variability is the key to adaptation. Contrary to popular (Lamarckian) depictions of Darwin's theory, individual replicators neither adapt nor evolve. Only populations are capable of such feats because they carry within them a variety of slightly different individuals. When conditions change, some individuals are *already* better adapted to the new environment. They survive where others perish.

Competition is the unrelenting engine that drives natural selection. Without it, variability would increase without limit and organized structure would never emerge from the chaos. Such limitless growth is manifestly impossible in the real world, due to the simple fact that growth requires resources. At some point, all replicators will run out of material with which to make copies of themselves. Those who are better able to secure those resources will propagate themselves into the future.

Inheritability is essential to evolution because it allows the process to continue through time as a series of compounding iterations. Thus, tremendous complexity can arise from an essentially mindless process. Inheritability links survival directly to the ability to reproduce; other characteristics only contribute to survival insofar as they help a replicator replicate.

DNA evolves because its chemical composition allows it to replicate itself, through cell division, and pass its traits along to its descendants. However, this process is not perfect and variation soon arises between individuals. Genetic replication requires chemical resources, which are often scarce, so organisms must compete with each other for the right to reproduce.

Dawkins and Blackmore argue that human behaviors also qualify as replicators. They are certainly variable, both within and between individuals. They reproduce through imitation and other forms of vicarious learning. They compete for survival by virtue of the fact that no one could possibly demonstrate every behavior in their repertoire to every person they encounter. Some behaviors *must* be displayed, and

therefore imitated, more often than others. The forces that determine which behaviors survive and which fade into disuse are called selection pressures (see below).

Fecundity, Fidelity, & Longevity

Whether genes or memes, all replicators can follow three paths to reproductive success. The first is to make as many copies of oneself as quickly as possible. This is the path of fecundity. It leads directly to dominance of a population, by sheer weight of numbers, but it's very costly in terms of resources. The ebola virus has not spread as far as HIV because it reproduces so quickly that its victims often die before they can infect others. HIV, on the other hand, is less aggressive and gives its hosts years to spread their affliction.

The other two paths are more circumspect. Fidelity is the precision with which a replicator copies itself. This is a double-edged sword; low fidelity means that a replicator's descendants will naturally change into something else over time, but high fidelity reduces variation and adaptability. This kind of catch-22 is sometimes called a "limit cycle" (Briggs & Peat). Urban legends display low fidelity when the details change every time they're told, until the original story has been replaced by countless derivatives that bear little resemblance to the original. Religious scripture displays high fidelity because social forces actively resist changes in dogma.

Longevity is exactly that: the lifespan of an individual replicator. The longer a replicator persists, the more copies it can make. Longevity may also allow a replicator to "wait out"

adverse conditions and resume activity at a later date, like animals that hibernate during winter. Computer viruses have extraordinary longevity because they can lurk on hard-drives, disks, CDs, or other storage media as long as that device remains intact. They also demonstrate the power inherent in combining these paths: a computer virus could hide on an old computer for years (longevity), then infect hundreds of others as soon as it's connected to a network (fecundity).

Memetic Selection

Memes spread through society based on how well they balance fecundity, fidelity, and longevity. However, there is another important side to this equation: the environment. Nothing evolves in a vacuum, but only as it interacts with the world around it. The environmental factors that determine which replicators survive, and which ones die out, are called "selection pressures."

Susan Blackmore dismisses so-called "Skinnerian learning" as irrelevant to the propagation of memes, but Learning Theory has a lot to offer memetics. It makes specific predictions about the environmental conditions that cause behaviors to increase or decrease in frequency (i.e. the conditions that influence fecundity). These insights fill in some important theoretical gaps.

The first principle of Learning Theory is deceptively simple: behaviors increase when they are rewarded and decrease when they are punished. Furthermore, removing a reward has the same effect as administering a punishment, and

removing a punishment has the same effect as giving out a reward. Rewarding a behavior each and every time it occurs produces the most behavior the quickest, but rates drop off as soon as the rewards stop coming. Behaviors are often rewarded or punished only after a certain number of instances (a ratio), or only after a certain period of time has elapsed (an interval). Using the same ratio or interval every time produces regular spikes of behavior, while varying the ratio or interval produces an even rate of highly persistent behavior. These could be called the laws of memetic fecundity.

Memetic fidelity is bounded by the limits of human memory and vocabulary. Reproducing a behavior or an idea precisely takes more time and effort than reproducing it approximately. Complexity exacerbates this problem, so simple memes will tend to replicate with more ease and more fidelity than complicated ones. (Witness the difference between scientific literature and lay-science, or between theology and popular religion.) Assuming that beliefs which accurately model reality tend to be more complex than less accurate ones, this also means that truth is always at a memetic disadvantage!

During times of cultural and historical change, fidelity is even more of a liability. Without high variability, a meme pool will be unable to adapt to new environments. Take, as a genetic example, the famous finches of the Galapagos islands. During periods of drought, finches with larger beaks dominate the gene pool because they are better for eating dry seeds. Small beaks are more common at other times because they are better for eating everything else. If the finch population didn't contain

disadvantaged large beaks between dry periods, the entire species would die out as soon as the rains stopped! Variability is essential for adaptation, but too much of it causes chaos.

Memory also places an upper limit on the longevity of memes. It takes rehearsal to keep memories fresh and practice to keep skills sharp. Memes cannot lie dormant in the mind for very long before they begin to decay. This is why humans go to such great lengths to encode knowledge in the environment, from street signs to stonehenge to the written word.

The Written Word

Speech was mankind's first communication technology. Compared to the non-verbal languages of other animals, the spoken word was a profound leap forward. According to Blackmore, it kick started memetic evolution as a process parallel to, but much faster than, genetic evolution. From the point of view of speechless protohumans, the rise of spoken language must have seemed like a technological singularity!

However, speech has its limitations. First and foremost, it is ephemeral. Spoken words persist for only a moment and oral traditions change with each retelling. Speech is also limited in range, reaching only as far as the speaker can shout. It makes communication, by necessity, a face-to-face enterprise.

The invention of written languages, especially alphabets, drastically increased the longevity and fidelity of memes. Though the latin alphabet is the most widely used today, other systems of writing were developed by various civilizations over a period of

about two thousand years. In most cases, this event marked the beginning of the historical record: memes put into writing have survived to the present whereas those preserved solely in oral tradition have not. That's the very definition of longevity!

However, writing did nothing to increase the fecundity of memes. Before Gutenberg, reproducing a book was a slow and costly endeavor. They were treated as heirlooms, reserved for the rich and members of the clergy. Speech still set the benchmark for how *quickly* memes could spread.

A memetic analysis predicts that these pressures would favor the memes of the wealthy and educated classes. The combination of longevity and fidelity would produce a gradual reduction in variability. It would also allow complexity to accumulate over time, but the cost would be a gradual loss of adaptability.

The first prediction is easily confirmed. The most ancient memes still at large in the western world are Greek philosophy and mathematics, Roman histories, and the great world religions. There is comparatively little in the historical record concerning the lives or folk lore of "common people." The memes of those who could not write have dropped out of the meme pool. (In the cases of book burnings and heretical texts, they have been forcibly removed!)

Though the pace of memetic evolution before the advent of writing is hard to know, there can be little doubt that the level of cultural and technological sophistication has been accelerating throughout the last few millennia (Wright, 2000). M.T. Clanchy and Brian Stock have documented literacy's ability

to ease demands on human memory, and easier replication allows ideas to build on each other. This is how writing leads to increased memetic complexity.

Reduced variability and lost adaptability are more difficult to demonstrate. There's a case to be made concerning the inflexibility of religious and political ideologies, but would they be any more adaptable if they were never written down? There's no way to know for sure, but their spread has certainly reduced over all variability in the meme pool. Since variability and adaptability are directly related, it is reasonable to conclude that the global meme pool has lost considerable adaptivity.

Meme theory accurately predicts class bias in the historical record as a function of increased longevity and fidelity for memes that are recorded in writing. It also predicts the steady acceleration of cultural, technological, and historic change as a result of these same selection pressures. However, it also implies that these gains have cost humanity much of its memetic adaptability. Unfortunately, the dominant communication technologies of the twentieth century did little to correct this state of affairs, despite bringing to bear a very different set of selection pressures.

Radio & Television

Broadcast telecommunication is almost the polar opposite of the written word. Whereas etching a meme in stone makes it virtually immortal, sending it over the airwaves makes it as fleeting as speech. The power of radio and television lies in its reach and speed. Broadcasting memes to audiences of millions, across hundreds of thousands of miles, amplifies their fecundity by orders of magnitude!

Even so, the broadcast model suffers from a scarcity of bandwidth. There's only room for a small number of content providers relative to audience members (especially in the days before cable and satellite services). The paucity of broadcasters means that only a few memes can benefit from the increased fecundity. Naturally, those memes are chosen by the people who own the technology. This leads to exactly the same class bias exhibited in the written record, but on a far grander scale. In the words of Lance Bennett, a communications theorist...

"Perhaps the most obvious political effect of controlled news is the advantage it gives powerful people in getting their issues on the political agenda and defining those issues in ways likely to influence their resolution."

Conditions of high fecundity and low longevity would normally produce a vibrant meme pool through fierce competition. When only a subset of the available memes enjoy these benefits, however, the result is merely a small and

homogenous meme pool that experiences rapid turnover. One would expect the pace of historical change to accelerate, but only as each dominant ideology replaces its predecessor.

Post-war propaganda was the first manifestation of these forces. Nancy Bernhard has documented the collaboration that took place between the American government and media companies in the years following World War II. Broadcast technology allowed them to engineer and disseminate a memplex that favored Cold War era military build-up and suppressed political dissent. Once again, those memes that had access to the technology thrived while those that did not faded into obscurity.

During the 70's and 80's, government control gave way to market forces and "mainstream culture" was born (Winston, 1998). Mass media epitomizes the drawbacks of broadcast selection pressures. Because advertisers are only interested in reaching certain populations, minority groups and sub-cultures are left by the wayside. It is simply not profitable to broadcast to small audiences. The general meme pool loses diversity as mainstream culture cannibalizes smaller memplexes.

Biological species know well the dangers of homogenization. Sexual reproduction is far less efficient than the asexual method that preceded it. Despite this, the increase in genetic variation is so valuable that virtually all complex organisms exhibit sexual dimorphism. It allows species to evade disease, exploit new niches, and survive periods of environmental change. Diversity is essential for survival.

A final bit of circumstantial evidence for the importance of

broadcast communication in modern memetic evolution comes from the results of the 2004 Presidential election. Though the American electorate is split rather evenly between two competing memplexes, the common geographical depiction of this split (the so-called "red and blue states") is an illusion created by the all-or-nothing mechanics of the American voting system. In fact, the division shows only a slight geographical bias, and even then only between urban and rural areas regardless of region (Vanderbei, 2004). Television and radio reach into every home, freeing the memes they carry from the spatial limitations of speech. Memes that travel only via the more spatially limited technologies are only powerful enough to produce a slight bias in this otherwise even distribution.

Mass media and mainstream culture are direct effects of the memetic selection pressures imposed by broadcast technologies. Radio and television increase the fecundity of memes, which accelerates the pace of cultural change, but the one-to-many broadcast model ensures that only a fraction of the available memes enjoy these benefits. The result is a homogenous and less adaptive meme pool. The diaspora of cable and satellite television feeds during the 1990's did alleviate this homogeneity to some extent, but the real progress is being made by a new kind of telecommunication.

The Internet

Originally conceived by the Department of Defense as a communication system that could survive a large scale nuclear attack, the internet exploded during the 90's into a whole new memetic ecosystem (Briggs & Burke). It combines the best aspects of broadcast and print with a feature that no communication technology has possessed since speech: it's social. Even now, mankind is just beginning to see the fundamental transformations this 21st century philosopher's stone will catalyze.

At its root, the internet is a low-cost means of producing and distributing text. As such, it confers the same longevity and fidelity benefits as print. Though it has not yet reached the same market penetration as television, it has the technical capability to do so. (Due to its international nature, the internet already exceeds television's reach in many respects.) As it grows, so will the fecundity of its memes.

Unlike both of its immediate ancestors, the internet can connect people in many-to-many relationships. Every consumer of content also has the capacity to become a producer of content, even if it's only by posting comments to a weblog. This means that a wider, more representative sample of all available memes are able to benefit from the increases in fidelity, fecundity, and longevity.

The shift away from geographically bound meme pools has already been demonstrated, but the internet will enable the same shift for one's social networks. It will lead to the death, or

at least crippling, of mainstream culture. This social fragmentation, coupled with lowered barriers to entry, will result in renewed competition among memes in a far more diverse environment. Increased diversity means improved adaptability. Finally, the pace of historical change will continue to accelerate, eventually reaching a cultural singularity.

Subcultures already flourish online. There are discussion forums that cater to every special interest from circus arts to oxygen therapy. Barry Wellman sees the internet as the next phase in an existing trend away from local, all-encompassing social groups towards distributed, personalized social networks. Howard Rheingold has documented some of the first ad hoc political organizations, a more goal-directed incarnation of this trend. In one study, Wellman and his colleagues demonstrated that internet use supplements other channels of social interactions, rather than detracting from them (Wellman, 2001). These are all signs of the steady erosion of unified, homogenous "mainstream" culture.

Meme theory predicts that improved adaptability will be a direct result of this diversification. Rather than the long pendulum swings of public opinion that characterized the twentieth century, future history will seem like a constantly shifting miasma of ideas. Futurists have hypothesized about a point in human history where technological advances become too frequent for individual humans to keep up. They call it a "singularity" because, like the event horizon of a black hole, it's impossible to understand the reality on the other side. Exponential social fragmentation could have a similar end

result, accelerating the pace of cultural change beyond anything individuals could hope to master. Our memes would take on a life of their own, leaving humanity to ride in their wake.

As frightening as such a future may seem, it's hard to argue that it would be harmful to society. After all, it's a direct product of increased memetic variability and a sign of exponential improvement in the meme pool's ability to adapt. For all that, there is one good reason to believe there's an upper limit to the pace of cultural change: fecundity consumes resources. In this case, the resource would be the human capacity to exhibit and imitate behaviors. If change is occurring too fast for humans to keep up, then change may have no choice but to slow down. Cultural singularity may be more like the speed of light than an event horizon: an asymptotic upper limit that can never be crossed.

Conclusions

Communication technologies transform societies via their effects on memetic selection. All human behaviors can be conceptualized as memes: replicators that evolve through a process of selection. Like genes, human behavior exists in varied forms, reproduces itself (through imitation), and experiences a competition for survival. When these three conditions are met, evolution *must* occur.

However, evolution never happens in a vacuum. It occurs through a replicator's interaction with its environment. The forces that determine which memes thrive and which die out are called

"selection pressures." Communication technologies from speech to the internet act as an environment for memes and the specifics of their design determine the selection pressures they impose. Understanding those forces provides valuable insights into the course of cultural evolution.

The preservation of Greek philosophy and the world religions bears testament to the written word's ability to make any meme immortal. Writing increases the longevity and fidelity of memes; they last longer and make more precise copies of themselves. Memes that are never written down (often because they are not rewarding to the wealthy or educated classes) suffer a disadvantage in the competition for survival and, over time, they drop out of the meme pool.

Mass media and mainstream culture are created by the particular strengths and limitations of broadcast technology. Television and radio increase the fecundity of memes by distributing them instantaneously to enormous audiences. However, they confer none of the longevity benefits of the written word. Their speed and reach accelerate the pace of cultural change, but only for a limited subset of existing memes: those preferred by the people who create broadcast media and own broadcast technology. The end result has been the homogenization of culture and a loss of memetic adaptability.

The internet is the first telecommunication system that connects people in the many-to-many relationships that make social behavior possible. It combines the longevity of text with the speed and reach of television. Because every user also has the ability to contribute, it ensures that a more representative

cross section of the meme pool will have access to these benefits. This unique arrangement of selection pressures will escalate the trend towards fragmented social networks and accelerate the pace of cultural change to a singularity. Whether this represents an event horizon that will fundamentally transform the nature of society or an inviolable upper limit to the speed of memetic evolution remains to be seen.

Darwin's theory of natural selection revolutionized the biological sciences, and now it is poised to do the same for the social sciences. Though deceptively simple, it is capable of explaining the awe-inspiring complexity of life in all its forms. Memetic analysis provides unique insights into the complex relationships between memes, technology, and culture.

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