

ON THE ORIGIN OF SOCIETIES

A DARWINIAN THEORY OF SOCIETAL EVOLUTION

A MATHEMATICAL FOUNDATION FOR THE SOCIAL SCIENCES

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Draft
(December 13, 2024)

PREFACE

In 2024, I published a book titled *Darwin, Turing, Dawkins* (Adleman) which explored a general theory of evolution. This article is a specialization of that theory to the social sciences.

Darwin, Turing, Dawkins is available for free download at ArXiv:
<https://arxiv.org/abs/2402.10393>.

Throughout this article DTD will refer to *Darwin, Turing, Dawkins*.

TABLE OF CONTENTS

PREFACE	II
INTRODUCTION.....	1
Social evolution.....	1
Evolution	2
PRENES.....	4
What is a prene?.....	4
The resurrection of smallpox	7
CULTURAL-PRENES.....	12
What is a cultural-prene.....	12
How to be an unsuccessful cultural-prene.....	13
How cultural-prenes organize people	15
How cultural-prenes acquire people	16
How cultural-prene-sets program their own mutations	19
The prophet and the messiah	20
The societal ecosystem	23
The struggle to survive	23
MUTATIONAL POWER.....	25
The complexity of societies.....	25
Greatness	26
MEMBERS OF SOCIETY	28
Cultural-prenes and members of society.....	28
The human brain.....	28
A person's cultural-meme-set	30
Cultural-prenes and emotions.....	31
THE ORIGIN OF SOCIETIES	33
BIBLIOGRAPHY.....	35
FIGURES	36
ABOUT THE AUTHOR	37

INTRODUCTION

SOCIAL EVOLUTION

Herbert Spenser was a 19th century English polymath. He is widely considered to be one of the founders of the field of sociology.

Remarkably, he coined two phrases that remain familiar to this day: “survival of the fittest” and “social evolution”.

Spenser was a contemporary of Charles Darwin, and the two exchanged numerous letters regarding research.

Spenser’s work on the evolution of societies began before Darwin’s publication of *On The Origin Of Species* (Darwin, 1859). In that book, Darwin acknowledges Spenser as follows:

Mr. Herbert Spenser, in an Essay (originally published in the 'Leader,' March 1852, and republished in his 'Essays' in 1858), has contrasted the theories of the Creation and the Development of organic beings with remarkable skill and force.

...

The author (1855) has also treated Psychology on the principle of the necessary acquirement of each mental power and capacity by gradation.

Spenser’s work on the evolution of societies received mixed reviews from other prominent sociologists:

Spencer's concept of social evolution provides a useful framework for understanding the development of societies.
-Max Weber

Spencer's theory of evolution is a valuable contribution to sociology, even if it is not entirely accurate.
-Emile Durkheim

Spencer's theory of evolution is a reactionary ideology that justifies the status quo.
-Karl Marx

Over a century has passed since Spenser and Darwin completed their work, and in that time much has been learned. Equipped with this new knowledge we will pick up the work that Spenser began and explore a new theory of evolution in the social sciences.

EVOLUTION

Darwin was not the first to observe evolution in biology. In his works, Darwin cites thinkers going as far back as Aristotle, that in one way or another observed evolution and attempted to explain it.

In *On The Origin Of Species*, Darwin cites Lamarck, who in 1802, 7 years before Darwin's birth, had published *Recherches sur l'organisation des corps vivans*, wherein the theory of evolution now known as Lamarckism was put forth. Unfortunately, Lamarck's theory was wrong in important respects and insufficient in others.

What Darwin contributed was the first theory of how and why evolution occurred that could pass scientific scrutiny.

Beginning with Herbert Spenser and Auguste Comte, many social scientists have taken up the challenge of developing theories of social evolution. Among the early thinkers whose works touched on the topic were Lewis Henry Morgan, Edward Burnett Taylor, Talcott Parsons, and Immanuel Wallerstein.

In *On The Origin Of Species*, Darwin had laid out the fundamentals of biological evolution: variation (the birth of individuals that were not identical to their parent(s)) and natural selection (survival of the fittest). After Darwin, generations of distinguished biologists would refine the theory. To recall them all, would require recounting a large part of the history of biology; so, I will content myself with recalling what is arguably the most important refinement.

In 1953, Watson and Crick published their masterpiece, "A Structure for Deoxyribose Nucleic Acid" (Watson & Crick, 1953). The now ubiquitous "double helix" had been revealed. The "agent" of biological evolution had been found.

The paper contains the famous understatement:

It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.

Presumably, it also did not escape many biologists notice that mutation of DNA and sexual reproduction could give rise to the variation so critical to Darwin's original theory.

For millennia, biology has been viewed as “the study of living things”, but after Darwin and his successors, a second view of biology as “the study of genes” has emerged. From this view, living things are seen as instruments used by their genes to preserve and reproduce themselves. While some may see these views as competitive, I see them as largely synergistic; together, they have transformed our understanding of biology.

Social science has long been viewed as “The study of human society and social relationships” (OED, 2022). The question arises as to whether a complementary view of social science as the study of some agent analogous to genes might be of value. It appears that it can, and the agent of societal evolution is the “cultural-prene” which will soon be defined.

PRENES¹

WHAT IS A PRENE?

Let's begin with a related question: What is a gene? Here is what you'll find in The Oxford English Dictionary (OED, 2022):

1. *Biology.*

a. *The basic unit of heredity in living organisms, originally recognized as a discrete physical factor associated with the inheritance of a particular morphological or physiological trait, and later shown to be located at a specific site on a chromosome and to consist of a sequence of DNA (or RNA in certain viruses) containing a code for a protein or RNA molecule, together with any associated sequences necessary for transcription and translation.*

This is not a very precise definition. For example, what exactly does “The basic unit of heredity” mean? Nonetheless, the notion of a gene is of great importance in biology, and OED-type definitions are useful in that field.

From the OED definition we could extract the following:

A gene is a basic unit of heredity that can be stored in DNA and RNA.

From here, it is a short step to the definition of a prene.

A prene is a basic unit of information that can be stored in physical things.

So now, instead of speaking of the “insulin gene”, we can speak of the “insulin-prene”. Instead of restricting ourselves to DNA and RNA, we can consider other forms of physical things that might be storing it. Are there such things? Yes. For example, the insulin-prene is stored in computers, and assuming you are using your computer to read this, it is stored in yours. Here it is:

¹ *Prene is a portmanteau from primary and gene.*

The sequence below is the coding sequence of the human insulin gene. DNA nucleotide numbers are indicated to the left of each new line of sequence. Each line of sequence is 50 nucleotides long and there is a space between each set of 10 nucleotides. Portions of the DNA sequence that align with the mature mRNA sequence of human insulin are indicated in CAPS.

```

1  accccccac cccagccct aatgggccag gccgcagggg ttgagaggta
51  ggggagatgg gctctgagac tataaaagcca gcgggggccc agcagccctc
101 AGCCCTCCAG GACAGGCTGC ATCAGAAGAG GCCATCAAGC AGgtctgttc
151 caagggcctt tgcgtcaggt gggctcagga ttccagggtg gctggacccc
201 agggcccagc tctgcagcag ggaggacgtg gctgggctcg tgaagcatgt
251 ggggggtgag ccagggggccc caaggcaggg cacctggcct tcagcctgcc
301 tcagccctgc ctgtctccca GATCACTGTC CTTCTGCCAT GGCCCTGTGG
351 ATGCGCTCC TGCCCTGCT GCGCTGCTG GCCCTCTGGG GACCTGACCC
401 AGCCGCAGCC TTTGTGAACC AACACCTGTG CGGCTCACAC CTGGTGGGAA
451 CTCTTACCT AGTGTGCGGG GAACGAGGCT TCTTCTACAC ACCCAAGACC
501 CGCCGGGAGG CAGAGGACCT GCAGGgtgag ccaactgccc attgctgccc
551 ctggcccgcc ccagccaccc cctgctcctg gcgctccccc ccagcatggg
601 cagaaggggg caggaggctg ccaccacgca gggggtcagg tgcacttttt
651 taaaaaaga ttctcttgggt cacgtcctaa aagtgaccag ctccctgtgg
701 cccagtcaga atctcagcct gaggacggtg ttggctctgg cagccccgag
751 atacatcaga ggggtgggccc gctcctccct ccaactgccc ctcaaaacaaa
801 tgccccgcag cccattttct caccctcatt tgatgaccgc agattcaagt
851 gttttgttaa gtaaagtctt gggtgacctg gggtcacagg gtgccccacg
901 ctgcctgcct ctgggcgaac accccatcac gcccgagaga gggcgtggct
951 gcctgcctga gtgggcccaga cccctgtcgc caggcctcac ggcagctcca
1001 tagtcaggag atggggaaga tgctggggac aggcctgggg gagaagtact
1051 gggatcacct gttcaggctc ccaactgtgac gctgccccgg ggcgggggaa
1101 gggagtgagg catgtgggctg ttggggcctg taggtccaca cccagtgtgg
1151 gtgacctctc ctctaacctg ggtccagccc ggtcggagat ggggtgggag
1201 gcgacctagg gctggcgggc aggcggggcac tgtgtctccc tgactgtgtc
1251 tctctgtgtc cctctgctc gccgctgttc cggaaactgc tctgcgcggc
1301 acgtcctggc agTGGGGCAG GTGGAGCTGG GCGGGGGCCC TGGTGCAGGC
1351 AGCCTGCAGC CTTGGCCCT GGAGGGGTCC CTGCAGAAGC GTGGCATTGT
1401 GGAACAATGC TGTACCAGCA TCTGTCCTCT CTACCAGTC GAGAACTACT
1451 GCAACTAGAC GCAGCCCGCA GGCAGCCCCA CACCGCCCGC CTCCTGCACC
1501 GAGAGAGATG GAATAAAGCC CTTGAACCAg cctctgtgtg ccgtctgtgt
1551 gctttggggg cctctgggcca agccccactt cccggcactg ttgtgagccc
1601 ctcccagctc tctccacact ctctgqgtg

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Figure 1

Interestingly, storage in DNA, RNA, and computers are in some sense equivalent. Thanks to advances in computer and biological technology, given the insulin-prene stored in one of these forms, we can create copies stored in the other two. It is remarkable, that if the copy stored in your computer became the last copy that existed, it would be easy to make a plethora of new copies stored in DNA or RNA, that could be used, for example, to treat some forms of diabetes. This equivalence also has surprising and disturbing consequences as will be elucidated in *The resurrection of smallpox*.

We will refer to prenes derived from genes in the manner just described as “genetic-prenes”.

Now that we have a definition of prenes, we might ask whether genetic-prenes are the only examples. The answer is no. Consider this:

To be, or not to be, that is the question ...

Hamlet's soliloquy. It is stored in books as a sequence of letters. It is stored in computers as a sequence of zeros and ones. It is stored in people's brains in a manner yet to be elucidated by science.

So, what is Hamlet's soliloquy? It is a prene, which we will call the Hamlet's-soliloquy-prene.



Figure 2: The Hamlet's-soliloquy-prene stored in the Brandeis First Folio (left), on a computer (middle), and in Lawrence Olivier's brain (right)

Hamlet's soliloquy is clearly not a gene, and therefore, the Hamlet's-soliloquy-prene is not a genetic-prene. It is our first example of a "cultural-prene".

Let's develop a bit of nomenclature.

A "copy" of a prene is a physical object that stores it. The most important thing to know about a prene is its current "copy number" – the number of distinct physical things in which it is stored at this moment. It is likely that the Hamlet's-soliloquy-prene is currently stored in millions of books, millions of computers, and tens of thousands of brains. Perhaps, it's current copy number exceeds a billion.

If the current copy number of a prene drops to zero, the prene has gone extinct.

For example, it is known that some of Shakespeare's plays have been lost; so, barring a miraculous find, the prenes once stored in written copies of those plays have gone extinct. The same can be said for the genetic-prenes associated with many Tyrannosaurus Rex genes.

The fundamental thesis of this article is that all prenes obey the following law:

All prenes struggle to avoid extinction.

I have used the word “struggle” for historical reasons. Chapter III of *On The Origin Of Species* is titled “Struggle for existence”. However, as Darwin made clear, “struggle” in the context of evolution need not have some of the connotations associated with the word in common use. For example, when two species of flowering plants “struggle” with one another to attract bees that will spread their pollen, there is no apparent conflict or suffering. The plants are not aware of prenes or their struggle. This is the case with all living things, including humans (with the exception of those modern humans who have learned about evolution through scholarship).

The works of Darwin and subsequent scientists have allowed us to understand how the insulin-prene has struggled to avoid extinction, but can it really be that the Hamlet’s-soliloquy-prene has also struggled to avoid extinction? The answer is yes, as we will see in *The struggle to survive*.

Like the gods of mythology, prenes are immaterial but carry out their activities through humans and other physical things. Prenes began their journey long ago and will continue it long into the future. We are merely evanescent creatures swirling in their wake.



Figure 3: Destiny

THE RESURRECTION OF SMALLPOX

As we saw in *What is a prene?*, the insulin-prene can be stored in DNA, RNA, and computers, and that DNA, RNA, and computers are equivalent in the sense that if it is stored in one of these forms, we can create copies in the other two. Traditionally, as reflected in the OED definition of gene, biologists have largely focused on genetic-prenes stored in DNA and RNA and have paid little attention to the implications of computer storage. This restricted view may have deadly consequences for humanity.



Figure 4: The smallpox virus. Dead or just playing possum?

The following editorial appeared in the New York Times. For obvious reasons, I did not use the language of prenes, but, at its core, that is what it is about. It addresses the question: has smallpox been eradicated? The world has always looked at this as a question of biology, that is, as a question about RNA and DNA, but when computers are given consideration, the view is strikingly different.

*By Leonard Adleman
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On Oct. 16, 1975, 3-year-old Rahima Banu of Bangladesh became the last human infected with naturally occurring smallpox (variola major). When her immune system killed the last smallpox virus in her body, it also killed the last such smallpox virus in humans. In what is arguably mankind's greatest achievement, smallpox was eradicated.

Our war with this smallpox virus was brutal. It appears likely that the virus killed about one billion of us. Initially, our only defense was our immune system, but eventually we developed new tools, including vaccination. In the late 1950s, the World Health Organization began responding to outbreaks by vaccinating

everyone in the surrounding area to prevent the virus from spreading. By 1975, we had won.

The smallpox virus had only a single host species: us. Other viruses have multiple hosts. For example, some strains of flu live in both humans and pigs, hence “swine flu.” If smallpox had had a second host, eradicating it in humans would have been of little value, since it would have thrived in its second host and later re-emerged in humans.

A few samples of the virus are still kept in special labs: one in the United States and one in Russia. We don't bother vaccinating against smallpox anymore; if the virus escapes from one of these labs, the war will begin again. Currently, there is debate about whether these samples should be destroyed or kept for scientific purposes.

But the debate should be broadened. Even if we destroy those samples, the war is not over; the smallpox virus has now found a second host. It is not the pig. In fact, it is not even what we think of as a living thing. It is the computer.

This is not some conceptual game. This is real and life-threatening.

If you search online, you can find the sequence for the smallpox genome. It is a word written with the letters A, T, C and G. The word is about 185,000 letters long. It is the word that tells cells to make smallpox viruses. The sequence was stored on a computer in the early 1990s, when a research team led by J. Craig Venter obtained it using a biotechnical process applied to a sample of the virus.

Of course, a word in a computer file cannot kill you. Well, yes and no. In the 1990s, I ran a biotechnology laboratory. In my lab there was a machine much like a soda dispenser, only in this case the reservoirs were filled with chemicals. If I typed in a short word of my choice using the letters A, T, C and G, the machine would squirt one chemical after another into a test tube. When it was done, the test tube would contain trillions of molecules of DNA. Each would look like a necklace, with molecules of

adenine, thymine, cytosine and guanine (the building blocks of DNA) strung according to the word I had typed.

At that time, the 10,000-letter sequence of the H.I.V. genome was available online. I contemplated using my machine, together with well-known biotechnical methods, to create, de novo, the H.I.V. genome — an actual molecule identical to that found in H.I.V. viruses living in the wild. I had reason to believe that inserting such a synthetic molecule into a living human cell would cause the cell to manufacture full-blown H.I.V. viruses that could then be transmitted from person to person and cause AIDS.

I decided not to do the experiment, but I began to worry. If I could do it, so could others with high-tech labs.

Which brings us back to smallpox. Might someone resurrect it? You may think this is mere speculation, but in 2002, scientists used the approach just described to produce an infectious polio virus. It is possible that the great labs, with great scientists, the best equipment and substantial funds, could overcome the considerable challenges that exist and resurrect smallpox right now. Before too long, more modest labs may be able to accomplish the same thing.

I am worried, but also amazed. Smallpox has miraculously and unconsciously saved itself through an extraordinary act of evolution. After thousands of years, it was on the verge of extinction; it existed in one small girl, and just before that girl's immune system killed its last living member, a sample was taken and stored in a lab. Years later, that sample was used by another lab to sequence the viral genome. The sequence was placed on a computer, infecting a new "species" that had just come into existence.

Do we sit and wait for the day when someone releases resurrected smallpox on an unvaccinated world? I'm a scientist, not a policy expert. But would it be wise for us to consider limiting the distribution of the tools of this emerging technology?

So, at virtually the last possible moment, the smallpox-genome-prene made the leap from DNA storage to computer storage and was saved from extinction. I cannot think of an evolutionary miracle more remarkable.

Soon, it will be common to see “migration” of prenes from nucleic-acid storage to computer storage and vice versa. There are already some interesting examples.

A group at the European Bioinformatics Institute (Goldman, et al., 2013) has stored all of Shakespeare’s Sonnets (or, in prene terminology, the Shakespeare’s-Sonnet-prene-set) in DNA molecules. A group at Harvard (Shipman, Nivala, Macklis, & Church, 2017) has stored Muybridge’s famous 1878 movie “The horse in motion” in a DNA molecule, placed inside a bacterium. When the bacterium divides, the movie gets replicated, and hence the copy number of the The-Horse-in-Motion-prene increases. With time, the DNA molecule is in each of billions of bacteria. Given a bacterium, the DNA can be retrieved, the movie recreated and then screened.

CULTURAL-PRENES

WHAT IS A CULTURAL-PRENE

Consider the extinct Maya society of the Yucatán Peninsula. Presumably, the Maya had prenes concerning law, religion, war, food, relationships, and lots of other things. Some of these prenes would probably have been stored in brains, for example as stories or songs. The Maya developed writing and stored some in stone, skin, and paper. Taken together, these Mayan prenes correspond to what social scientists might call the Maya culture. We will refer to prenes in this set as cultural-prenes of the Maya culture and the set itself as the Maya-cultural-prene-set.

We have already seen a cultural-prene of the English-speaking society: the Hamlet's-soliloquy-prene.

Let's take a detour to address a few still unresolved issues. What exactly is the Maya-cultural-prene-set? If we asked two Mayas what was in the set, it seems unlikely they would agree. This problem also arises in biology. What is the human genome (or more properly the human genetic-prene-set)? With a small number of possible exceptions (e.g., identical twins), no two humans have the same genome. Despite this, the notion of a human genome is still useful. For similar reasons, I will continue to refer to a society's cultural-prene-set.

Another unresolved issue is illustrated by considering the Hamlet's-soliloquy-prene further. I think it likely that a significant portion of members of the English-speaking society are familiar with it, and only a small portion of members of the Mandarin-speaking society are. Similarly, it seems likely that a significant portion of members of the Mandarin-speaking society are familiar with the 紅樓夢-cultural-prene (the Dream-of-the-red-chamber-cultural-prene), while only a small portion of the members of the English-speaking society are. It seems that each prene is "important" in one society and of little importance in the other.

In American society, it seems obvious that the First-Amendment-prene is more important than the your-grandmother's-cornbread-recipe-prene stored on a piece of paper in a drawer in your kitchen.

In *Darwin Turing Dawkins* (Adleman), I have considered how to put this idea of importance on a more solid foundation; however, the issue is still not settled, so in this article, we will continue to think of importance informally.

All societies including religions, companies, nations, political parties, book clubs, family units, etc. have a cultural-prene-set.

Cultural-prenes provide a means of extending Darwinian evolution beyond biology and into the social sciences. Roughly, cultural-prenes and societies are

to the social sciences, what genes (or more properly genetic-prenes) and species are to biology.

While it is common to say that societies are “all about money” or “all about power”, they are not; they are all about the survival of their cultural-prenes.

HOW TO BE AN UNSUCCESSFUL CULTURAL-PRENE

The cultural-prenes of a society are not permanent residents. They enter the society’s cultural-prene-set, persist for a while, and then are “forgotten” (that is, the number of society members that store it in their brain declines to zero). Some persist very briefly, like the Y2K-cultural-prene. Some persist for a substantial period, like those related to popular fashions, recipes, songs, plays, and movies. Some appear to persist as long as the society exists, like the Declaration-of-Independence-prene of the American society, or the Shahada-prene of the Islamic society. Informally, I call those that persist only briefly “ephemera”, and those that persist for a long time “endura”. I suspect that the “important” cultural-prenes are typically endura (see DTD: *Endura and ephemera*).

The cultural prenes of a society have a substantial impact on the behavior of the society and each of its members. In this chapter, I will describe a cultural-prene of a religious society that has had a huge impact, much of it negative.



Figure 5: Shakers dance and worship. “I saw in vision the Lord Jesus in his kingdom and glory... I was able to bear an open testimony against the sin that is the root of all evil; ... the doleful works of the flesh” - Shakers’ Mother Ann Lee (ca 1770)

The Shakers were a Christian sect that arose from the Quakers in mid-18th century England. To the usual Quaker cultural-prene-set, they added new

cultural-prenes including the celibate-prene: sex is forbidden. I'll skip the details, but guess how many Shakers there are today?

No, you are wrong. Much to my surprise, the last time I checked, there were still two members (Wikipedia-Sa). However, I suspect your answer will be correct soon.

The celibate-prene dragged the Shaker society down to near extinction. There are several reasons for this, perhaps the most important is that the celibate-prene foreclosed one of the most basic approaches that a society can use to increase membership and make new copies of some cultural-prenes: have children.

Human babies are born with an open channel through which prenes store in the parents' brains may be transferred to the baby's brain. The Human genetic-prene-set arranged it to be so for its own survival. The reason is obvious: getting the don't-put-your-hand-in-the-fire-prene from your parents helps you and your genetic-prenes survive.

The Jewish, Christian, and Islamic societies do not make the "mistake" of having the celibate-prene in their cultural-prene sets. The Hebrew Bible virtually begins with a copy of an anti-celibate prene:

Be fruitful and multiply, and replenish the earth
-Gen 1:28 (KJV)

Islamic societies specifically exploit the parent-child channel. Some of the society's cultural-prenes direct the father of a newborn to whisper into the baby's ear, the first words the baby will ever hear, the Shahadah:

God is great
There is no god but Allah, Muhammad is the messenger of Allah.

Thus, at least in theory, the Shahadah-prene's copy number rises.

When the Shakers society first arose, it would not have been difficult to see that its cultural-prene-set might contain the seeds of the society's demise. Can an analysis of the Jewish, Christian, Islamic, Russian, American, Republican, Democratic, and other societies' cultural-prene-sets reveal some of their strengths and weaknesses and provide a glimpse into their futures? I believe it can.

In *The prophet and the messiah*, I will speculate on whether the Jewish-cultural-prene-set contains the seeds of its own demise.

While we can see the potential negative consequences of the celibate-prene, it is unlikely that many Shakers gave them much notice. It typically serves a society to have its members hold favorable views of the society's most important cultural-prenes.

For example, as an American, I have learned to cherish the First Amendment of the US Constitution. However, as a prene theorist, I am less enamored.

Freedom of speech, the press, and assembly are two edged swords that can be beneficial in some settings and detrimental in others.

Abraham Lincoln appears to have been aware of this when he suspended freedom of the press during the Civil War because it could be used to "give aid and comfort to the enemies of the United States" (Lincoln, 1864).

It could also be argued that freedom of the press exposes governmental abuses and thereby provides a defense against dictatorship.

We could argue endlessly about which position is superior. But our opinions are of little importance. The fate of the American-cultural-prene-set (and of American society) will be determined on the field of battle where it will struggle to survive against fierce competition from the cultural-prene-sets of other societies. From the prene-theoretic perspective, the First-Amendment-prene is of value to American society only if it contributes to that survival.

HOW CULTURAL-PRENES ORGANIZE PEOPLE

How does a person become a president, a monarch, or a pope? For example, how did Jorge Mario Bergoglio become Pope Francis? From the traditional view of history, much is known. He was born in Buenos Aires, had early jobs as a bouncer and janitor, joined the Church and moved from priest, to archbishop, to cardinal, and eventually to pope when his predecessor, Pope Benedict XVI, resigned (Wikipedia-Po). There are numerous biographies that provide additional information.

From the cultural-prenes view, Bergoglio became pope because the Catholic society's cultural-prenes chose him for the job. More generally, a society's cultural-prene-set assigns positions (and therefore tasks) to members of the society.

Here is how they do it.

In many societies there are numerous positions that a member may hold. These positions are typically associated with rewards such as wealth, prestige, power, and personal satisfaction. It is typically possible for a member to move from their current position to another with greater rewards. Thus, the prospects of greater

rewards provide an incentive for each member to attempt to advance from their current position to a more rewarding one.

To advance, a member will typically be required to satisfy various conditions. For example, they may be required to demonstrate particular physical or educational attributes, or to acquire recommendations from others. They may be required to prevail in competition with others seeking advancement.

Where do we find the positions that are available, and for each the rewards that accrue and the conditions that must be satisfied? In the cultural-prene-set. For example, the US Constitution stores cultural-prenes that describe the position of president of the United States, some of the rewards that accrue, and some of the conditions that must be satisfied to obtain that position. Similarly, the apostolic constitution, *Universi Dominici gregis* stores cultural-prenes that describe some of the conditions required for obtaining the position of pope. I'll call the set of cultural-prenes that determine the society's positions, rewards, and conditions, the "positional-cultural-prene-set" of the society.

A society's positional-cultural-prenes will not only determine which positions will exist in the society, but will act like a sieve, filtering out members who seek a position for which they are unsuited, and filling positions with members who are likely to have the attributes necessary to perform their tasks well.

The behavior and efficiency of a society depend on the positions that are available, and the suitability of the members who fill them. For example, if there are many positions for warriors, and most are filled with competent people, then it is likely that the society will do well in wars. If there are many positions for farmers, they may do well in avoiding famine.

HOW CULTURAL-PRENES ACQUIRE PEOPLE

Upon birth you begin to acquire cultural-prenes from the societies to which you are exposed. Many of these societies existed long before you showed up, and they have been waiting for you. They have evolved extremely refined methods to make the most of their opportunity. They intend to exploit you.

The cheetah lies in wait and then, in a sudden astonishing burst of speed, overtakes and kills its helpless prey. The Venus fly trap uses the promise of food to entice its prey; then gently imprisons and consumes it. Societies have a great deal in common with these predators.



Figure 6: Ruthless predatory prene-warriors with their prey.

Let's explore how societies go about their work.

I will describe one approach used by the Catholic society as an example, but many other approaches by many other societies would serve as well.

If the Catholic society gains access to you, it will begin to use the “instruments” it controls, such as members, money, buildings, music, and art, to “infuse” you with cultural-prenes which you may store in your brain. The longer it can maintain access, the more cultural-prenes you will acquire. You may be taught the cultural-prenes of the catechism early on, but only much later, if at all, are you likely to be taught the *Universi-Dominici-gregis*-prene.

Many of the prey the Catholic society encounters will be children under the control of their Catholic parents. This typically provides a period of several years during which the child will be retained and infused with cultural-prenes. The society's cultural-prenes have evolved through centuries to make the most out of these opportunities. The child may be enrolled in church-associated schools, bible study groups, choirs, soccer teams, teen groups, etc. These “institutions” provide a means of extending the retention time of the growing child while additional cultural-prenes are infused.

Just as the positions in a society are determined by positional-cultural-prenes, the institutions are determined by a subset of cultural-prenes we might call institutional-cultural-prenes.

Among the most important things the society will do with the time available is to infuse the child with cultural-prenes, such as the be-fruitful-and-multiply-prene and what I'll call the “children-must-be-raised-in-the-faith-prene”, that will increase the probability that when the child grows-up, they will become a parent and repeat the process.

Not all children exposed to the Catholic society will stay the course. Some will abandon the faith, some will only go to church on holidays, some will become pope. Why does this happen?

Typically, the Catholic society will come into conflict with other societies for control of the child's behavior and their future acquisition of cultural-prenes. For example, perhaps the child will become a fan of the local professional sports team. That is, the "fan society" will succeed in infusing some initial cultural-prenes and begin controlling some behavior. What is to be done when the championship game falls on a Sunday?

When the child reaches adolescence, the genetic-prenes stored in their nucleic-acid molecules at birth, will make a strong bid for greater control. The adolescent will discover sex, and the Catholic society's cultural-prene-set will have to compete with the genetic-prene-set for behavioral control.

The Catholic society's cultural-prene-set has traditionally contained cultural-prenes that encourage sex but only within wedlock and only for the purpose of procreation. There are lots of Catholics, so this half-empty/half-full stance may have worked well.



Figure 7: The Catechism. That boy on the left though? Probably not going to be pope.

As an aside, discord between the genetic-prenes stored in nucleic-acid molecules at birth and the cultural-prenes acquired from societies can have psychological consequences, for example, when one does covet thy neighbor's wife. Nietzsche, Freud, and others have explored this discord, sometimes seeing it as a conflict between civilization and human nature.

Even if the child abandons Catholicism entirely, the cultural-prenes that have been infused may influence behavior and emotions throughout life. How this lasting influence is created will be discussed in more detail in *Cultural-prenes and emotions*.

A human is a limited resource with a finite lifespan. At each moment, a human can execute some fixed number of brain cycles and expend a fixed amount of energy. It is not possible to provide full service to all societies encountered.

In the end, you will acquire cultural-prenes from many different societies, and each will get a share of your resources.

The cultural-prenes of a society that acquires a small share will have little influence on you. Those of a society that gets a significant share will regularly impact your behavior and emotions and become “part of your life”. Those of a society that acquires a very large share, will occupy a huge portion of your time, energy, and thoughts, and become a center of your existence.

HOW CULTURAL-PRENE-SETS PROGRAM THEIR OWN MUTATIONS

Because environments are constantly changing, all genetic-prene-sets, cultural-prene-sets, and other prene-sets must mutate or hasten their extinction.

But how can a prene-set be sure it is making the “right” mutations, since what is right will depend on what changes the environment will make in the future?

It can't. But that does not mean it should make changes at random. The situation might be likened to stock investing. You can invest in stocks randomly, or you can be diligent and learn about companies, their leaders, and other features, and invest in only those that have, in your opinion, bright futures. It is likely that, on average, investors that use the latter strategy will do better than those that use the former.

In fact, successful prene-sets have evolved very sophisticated mutational strategies (see DTD: *Variation and natural selection*). Societies and species that have evolved good strategies for mutation have a better chance of surviving than those that have inferior ones.

Here is how the cultural-prenes of some successful societies carry out their mutational strategies.

Among the rewards associated with a position, there is a particular reward that is not given special consideration in the “traditional” view of the social sciences but is of great importance when considering the cultural-prenes view. It is the power to mutate some portion of the cultural-prene-set for some portion of the members.

For example, for Catholics, as one moves from priest to bishop to cardinal to pope, the set of cultural-prenes accessible to mutation increases to include those of greater and greater importance, and the flock of followers who are impacted grows. A priest may express his ideas regarding birth control and perhaps influence the behavior of a parish, but if a pope does it, as Paul VI did in 1968, and John Paul II did in 1994 (Wikipedia-Ch), the future behavior of millions of members may be changed dramatically.

The exercise of mutational power can produce changes in the society's cultural-prene-set in much the same way that mutations in nucleic acid molecules produce changes in a species' genetic-prene-set.

This system of associating positions with mutational power provides some societies with highly successful mutational strategies. For example, the positional-cultural-prenes of these societies will typically require members who acquire positions with great mutational power to have demonstrated their belief in some important cultural-prenes and their skills in defending them. Members lacking those attributes are filtered out.

This can be seen in the following American society positional-cultural-prene:

The Constitution, Article II, Section 1, Clause 8:

Before he enter on the Execution of his Office, he shall take the following Oath or Affirmation:—"I do solemnly swear (or affirm) that I will faithfully execute the Office of President of the United States, and will to the best of my Ability, preserve, protect and defend the Constitution of the United States."

This oath is no guarantee, but it is an example of the cultural-prene-set doing its best to assure that a president will use their great mutational power to protect important cultural-prenes. Notice that Article II, Section 1, Clause 8 is a positional-cultural-prene stored in copies of the Constitution that requires that the cultural-prenes stored in copies of the Constitution, including itself, be protected.

THE PROPHET AND THE MESSIAH

In *How to be an unsuccessful cultural-prene*, I discussed the Shakers and noted that their cultural-prene-set appeared to contain the seed of its own destruction. That seed was the celibate-prene:

sex is forbidden.

In this chapter, I will speculate on possible seeds of destruction that may be present in the Jewish cultural-prene-set.

We will need a bit of nomenclature. I'll refer to "Torah society". The members of Torah society are those people who treat the Torah as sacred. Those members would later be called People of the Book in Islam. Roughly speaking, BCE all members of Torah society were Jews, and all Jews were members of Torah society. So, Jewish society and Torah society began as the same thing.

As indicated in *How cultural-prenes organize people*, many successful societies use positional-cultural-prenes to define the positions members may hold, and for each position, the conditions that must be satisfied to attain it and the amount of mutational power that accrues. I suggested that successful societies use these positional-cultural-prenes to ensure that those who acquire great mutational power have the ability and motivation to act in the interest of important cultural-prenes. Presumably the conditions required for such a position ensure that those with inadequate ability or motivation are filtered out.

Consequently, when a society has positions with great mutational power, but the conditions filter out almost no one, it raises a suspicion that the positional-cultural-prenes are not being used in an optimal way.

It appears that the Jewish cultural-prene-set contains positional-cultural-prenes that create these kinds of positions, and that Jewish society has suffered greatly because of it. Consider the following prenes:

- The prophet-prene: God will reveal His word to special individuals called prophets.
- The messiah-prene: in the future a great leader will become king of the Jews and restore peace and justice to the world.

Let's start with the prophet-prene.

Listen to my words: "When there is a prophet among you, I, the LORD, reveal myself to them in visions, I speak to them in dreams.

Numbers 12:6 (NIV)

From the cultural-prene perspective this is a positional-cultural-prene that defines the position of prophet and associates it with an immense power to mutate the cultural-prene-set.

What were the conditions that had to be satisfied to attain this powerful position? The Torah did provide some guidance on how unworthy candidates were to be filtered out, but the instructions were not that clear. For example:

*You may say to yourselves, "How can we know when a message has not been spoken by the LORD? If what a prophet proclaims in the name of the LORD does not take place or come true, that is a message the LORD has not spoken. That prophet has spoken presumptuously, so do not be alarmed.
Deuteronomy 18:21-22 (NIV)*

As a result, in Torah society, virtually anyone could claim to have satisfied the necessary conditions and declare themselves a prophet. Since there was no practical means of accepting or rejecting such a claim, it might be accepted by some members and rejected by others. Perhaps most often, the subsociety of individuals who accepted the claim went extinct in short order, but in the case of Mohammed, it did not. It grew and became the Islamic society.

Now consider the messiah-prene. As with the prophet-prene, we have a positional-cultural-prene that defines a position and endows it with great power to mutate the cultural-prene-set.

As with the prophet-prene, the conditions that are needed to become the messiah are poorly defined. Perhaps one could argue that the Torah does require that the messiah be from the line of King David, but even today, that would be virtually impossible to determine.

In any case, almost anyone could claim to have satisfied the necessary conditions and be the messiah. Jesus made such a claim, as have many others (Wikipedia-Lis). In Jesus's case, the subsociety of people who accepted the claim eventually flourished and became the Christian society.

So, while initially all members of Torah society were Jews, after Mohammed and Jesus they could be Jewish, Muslim, or Christian.

So, Torah society now had three distinct subsocieties. The advent of the Islamic and Christian societies would contribute mightily to the growth of Torah society. However, since their inceptions, the Islamic and Christian societies have been in continuous wars with Jewish society (and each other). They are winning. The Christian and Islam subsocieties now make up 99.6% of Torah society, while the Jewish subsociety makes up only 0.4% (Wikipedia-Ma).

Interestingly, Islam removed the possibility of future prophets from its cultural-prene-set.

*Muhammad is not the father of any of your men, but he is the Messenger of Allah and the Last of the prophets
-Quran 33:40
(Shakir)*

THE SOCIETAL ECOSYSTEM

Societies frequently contain subsocieties. For example, the American society contains the California society which contains the Los Angeles society which contains the Walt Disney Company society. Each of these subsocieties will have its own cultural-prene-set and positional-cultural-prene-set that indicate the positions available, the rewards, and the requirements for obtaining them. These subsocieties are often in conflict, fighting for resources. The collection of subsocieties form a kind of societal ecosystem. These ecosystems can be as intricate as those considered in biology.

A society can sometimes be divided into two or more subsocieties such that virtually all members of the society fall into exactly one of them. For example, American society contains the old and young subsocieties, the rich and poor subsocieties, the Democratic and Republican subsocieties, the North and South subsocieties, the state subsocieties. These “disjoint” subsocieties typically have different cultural-prene-sets, and they are almost always in conflict to some degree. When such conflicts become sufficiently heated, we may use terms such as civil war, schism, or insurgency to describe them. For example, the American civil war, the Islamic schism, the American insurgency (also called the American Revolution).

THE STRUGGLE TO SURVIVE

Prenes are units of information, they are not physical, they cannot replicate. Copies of prenes are physical and it is the replication of copies that increases the prene’s copy number.

Roughly speaking, different forms of copies use different methods of replication.

For example, genetic-prenes stored in DNA or RNA are replicated using molecules called polymerases that are found in cells and laboratories. Those stored in computers can be replicated in many ways, for example, by copy-paste operations, by sending text messages or emails, by uploading to or downloading from the Internet, or through the action of computer viruses.

Let’s look at the Hamlet’s-soliloquy-prene. It is stored in written documents (e.g., manuscripts and books), brains, and computers. Those stored in computers can replicate in the same manner as genetic-prenes stored in computers. Those stored in brains can replicate through processes like teaching; when a student is taught the soliloquy, they have stored a new copy of the Hamlet’s-soliloquy-prene in their brain. Those stored in written documents can be replicated in many ways, for example by using scribes or printing presses.

In about 1600 when Shakespeare appears to have written Hamlet, the printing press had already been around for about a century and a half. An author could

write a manuscript, take it to a printer, and get hundreds of books made. Shakespeare's 1625 First Folio had a run of about 750 books, and each stored the Hamlet's-soliloquy-prene. The books sold well (Wikipedia-Fi) and subsequent expansions under the title "The Complete Works of Shakespeare" brought the number of copies of the cultural-prene into the millions. The Hamlet's-soliloquy-prene had gone viral.

But where was the struggle?

Ask any budding author how easy it is to get a publisher to print copies of their work. Publishers will only do it if they expect to be rewarded, which typically means they expect to make a profit from selling the books. Publishers understand that those who are famous are more likely to attract book buyers. This is why so many books on best seller lists are written by celebrities. Fortunately for the Hamlet's-soliloquy-prene, as the historical record shows (*Dobson, 2016*), Shakespeare was a celebrity, and this presumably had much to do with getting his works published.

What about Elizabethan authors with manuscripts that did not get published? They had lost the competition to use the most powerful means that existed at the time to create new copies, and consequently the cultural-prenes stored in their manuscripts are very likely to have gone extinct. There are very few manuscripts of plays written by Elizabethan authors that still exist, and none from Shakespeare (*Stewart, 2006*).

A few more remarks. The advent of the printing press was a great extinction event for cultural-prenes, similar to the extinction event that killed the dinosaurs. Many cultural-prenes that did not get printed went extinct.

The "printing-press extinction" is one of many. The "writing-extinction" is another. Despite the admirable work of archaeologists, the cultural-prenes of societies that did not use writing are largely lost to us. This includes all societies that went extinct prior to about 3500 BCE when writing was invented by the Sumerians. The "Internet extinction" is happening now, and there is a frenzied attempt to get various societies' important cultural-prenes to go viral. Those cultural-prenes that fail to do so, are likely to have little influence on future societies.

MUTATIONAL POWER

THE COMPLEXITY OF SOCIETIES

When a society's cultural-prenes have chosen a member for a position with great mutational power, they have done their best to assure that the person has the skills and desire to protect them. But as described in *How cultural-prenes acquire people*, humans acquire cultural-prenes from many societies, and each of these cultural-prenes will compete for the member's resources. This is one of the things that make societies so complex.

Consider the American president. Typically, they will be either Democratic or Republican. In fact, they will usually have acquired a position of great mutational power within their party and as a result will have demonstrated that they have the skills and desire to protect their party's cultural-prenes. Becoming president does not make these skills and desires disappear. For example, it was quite clear in 1860 when Republican Abraham Lincoln and Democrat John C. Breckinridge ran for president that the cultural-prenes they had acquired from their own party's would have a great impact on their behavior if elected.

Hence in a society, it is not only the cultural-prenes of the society that determine the behavior of members, but also the cultural-prenes members have acquired from other societies.

Constantine had acquired Christian cultural-prenes, and then used his mutational power in the Roman society to mutate the Roman cultural-prene-set in a way that ultimately led to Christianity becoming the state religion. Presumably, if Constantine had acquired Zoroastrian cultural-prenes rather than Christian ones, the history of the world would have unfolded in a very different way.

It is not unusual for those with great mutational power to use it for their own benefit. For example, Octavius accumulated mutational power from many sources over decades. By about 27 BCE, he had amassed sufficient mutational power to change Roman society from a republic to an empire and make himself de facto "ruler for life".

It is also not unusual for those with great mutational power, to use it to mutate the positional-cultural-prene-set to create new positions or remove old ones. For example, when a country is preparing for war, many new warrior positions will be created and filled.

It is not just those in high positions that use their mutational powers to change cultural-prene-sets. Mutational power is the power to mutate some set of cultural-prenes for some set of members. Those who possess little mutational power in a

society, may still possess great mutational power in a subsociety. For example, a parent may have great mutational power within a family subsociety; the manager of a restaurant may have great mutational power within that restaurant subsociety. Within these subsocieties they can mutate the cultural-prenes in much the same way that Constantine did.

On the Internet, we call people who have amassed a large “following” influencers. Influencers have some mutational power within the society of followers. For example, some influencers use their power to “recommend” that followers listen to a particular piece of music or buy a particular brand of clothing.

Today, influencers do not have as much mutational power within their societies as Constantine had in his; for example, they probably cannot send their followers to wars or prisons. However, I suspect that in the near future, we will see Internet influencers with large very large societies of followers and mutational power comparable to Constantine’s. When this occurs, political parties, nations, religions, and many other societies will no longer be geographically constrained, they will exist in cyberspace. But nothing will have really changed; these “cybersocieties” will still have human members and cultural-prenes. They will still battle for resources with other societies, and the behavior and emotions of members will still be greatly influenced by the cultural-prenes they acquire. The cybersociety’s evolution will still be governed by Darwinian laws and in particular their cultural-prenes struggle to avoid extinction.

As an aside, when one considers a family society, it is not clear what role genetic-prenes play in selecting people to have great mutational power.

GREATNESS

In 1841, historian Thomas Carlyle published this famous line (Carlyle, 1841)

The History of the world is but the biography of great men.

From the prene theoretic point of view, people become “great” by acquiring positions with great mutational power and exercising that power to create “great events”. Constantine acquired the position of emperor and had immense mutational power. He used that power to mutate the Roman cultural-prene-set in favor of Christianity. For many Christians, this is seen as a critical step in a process that ultimately resulted in Christianity becoming the largest religion in the world. Hence, many Christians see this as a great event and see Constantine as a great man. For some Jews, this is seen as a critical step in the emergence of antisemitism in western societies (Wikipedia-Hi). Hence, these Jews may see this as a catastrophic event and see Constantine as a scoundrel.

So, which is it, great man or scoundrel?

In prene-theory it does not matter. One of the virtues of the prene-theoretic view is that human values are largely irrelevant. With the genetic-prene view of biology, it is of little importance whether humans consider a species or individual to be cute, vicious, repulsive, etc. The only questions worth asking are those concerning the society's struggle for existence and the individual's role in that struggle. Similarly, with the cultural-prenes view of the social sciences, it is of little importance whether humans consider a society or individual to be evil, fair, war-like, Godfearing, etc. The only questions worth asking are those concerning the society's struggle for existence and the individual's role in that struggle.

Consider the democracy-cultural-prene: democracy is good, autocracy is bad. This is a cultural-prene that assigns values to forms of governance. If you are a member of American society, it is likely that you believe the democracy-cultural-prene. That belief can have a great influence on your behavior. For example, presumably Woodrow Wilson's assertion that we were entering World War I to "make the world safe for democracy." resonated with many future soldiers who held such a belief.

But when using the cultural-prene approach to the social sciences, these forms of governance are neither "good" nor "bad". Prene-theory is a scientific theory, and assertions must meet the science society's cultural-prene requirements for acceptance; "good" and "bad" as used here are not definable in a way that would pass scientific scrutiny.

A prene-theorist might ask if there is clear evidence that societies that adopt the democracy-cultural-prene survive longer than those that reject it. A review of history will show that clear evidence does not exist.

MEMBERS OF SOCIETY

CULTURAL-PRENES AND MEMBERS OF SOCIETY

There are many ways to define a society. Here, I'll assume that a society has human members and cultural-prenes.

If a society's membership drops to zero, that society has gone extinct, but what happens to the cultural prenes? They may survive. Here are a few examples.

It is currently thought that the society, perhaps that of the Essenes, that produced the Dead Sea Scrolls may have been extinct for about 2000 years when the scrolls reemerged in the middle of the 20th century, and some of the cultural-prenes they stored were resurrected as cultural-prenes of modern societies. For example, many recent translations of the bible rely on the dead sea scrolls as a primary source.

Similarly, it appears that Bach's Brandenburg-concerti-prene was not stored in even one brain for over a century; however, the prene was not extinct. It was stored in a manuscript in the archives of the Margrave of Brandenburg, where it remained, spore like, until about 1849 when it was rediscovered and published (c.f. Beowulf).

When the Western Roman society ended in 476 CE (by convention), many of its Christian-cultural-prenes had already found new homes in the cultural-prene-sets of other Western European societies.

THE HUMAN BRAIN

The genetic-prenes stored in your DNA built your brain and programmed it to carry out tasks that help the genetic-prenes survive.

Your brain is simply a computer with an operating system (see DTD: *What a piece of work is a man?*). When you were born, your brain had no information about abstract societal concepts such as democracy, baseball, or truth. It did have a lot of free memory which would fill with data (or more precisely, with copies of prenes) as you experienced the world. Whatever you now think about abstract societal concepts is entirely the result of what got put into your brain's memory.

Following Dawkins (Dawkins, 1976), we will call all the prenes stored in an individual's brain that person's meme-set.

Among the elements in your meme-set are things we call beliefs. In *Darwin, Turing, Dawkins* I explored putting the notion of belief on a firmer foundation (see

DTD: *Why do bees kill themselves?*). I defined a “belief” to be a meme that has a significant impact on a person’s behavior.

For example, when I was a child, I acquired the when-you-wish-upon-a-star-your-dreams-come-true-meme from the Walt Disney Company society and the don’t-put-your-hand-in-fire-meme from my parents (that is, my initial family society). Informally, one might say that I “know” both memes, but that I only “believe” the latter. This view is consistent with the definition just given since the don’t-put-your-hand-in-fire-meme has guided my behavior (at least around stoves) throughout my life, but the when-you-wish-upon-a-star-your-dreams-come-true-meme has had virtually no impact on my behavior.

Of course, how much impact on behavior is sufficient to make a meme a belief is somewhat elusive, but it seems reasonable to say informally that a meme that has a great impact on behavior is strongly believed, and one that has almost no impact on behavior is weakly believed, or more simply not believed at all.

Among the elements of your meme-set will be cultural-prenes from societies you have encountered. How did they get there?

They may have been acquired from other members of the society through processes referred to as education, indoctrination, brainwashing, enlightenment, entertainment, training, propaganda, etc. using tools such as speech, books, media, and the Internet.

We will call the subset of a person’s meme-set that are cultural-prenes that person’s cultural-meme-set.

Another important subset of a person’s meme-set is what I call the experiential-meme-set. Roughly, these are the memes a person acquires from the environment, typically through their senses. These are a person’s memories; the first serious injury, the first meeting with your future mate (see DTD: *How the brain captures memes*).

There is also a subset of a person’s meme-set, that the person creates themselves. Your genetic-prenes, for their own survival, have built people’s brains to be obligatory meme processors. We are constantly using our brains to process our existing memes and create new ones. The Hamlet’s-soliloquy-prene did not exist until Shakespeare processed his existing memes and created it in his brain. We will call this subset of a person’s meme-set the person’s created-meme-set.

Many of the cultural-prenes of modern societies began as created-memes in a single person’s brain. For example, many Christian cultural-prenes began in Jesus’s brain. Many cultural-prenes of western societies began in John Locke’s, and many in communist societies began in Karl Marx’s.

Created-memes are the reason I think of the human brain as the crucible of societal evolution.

It is worth mentioning that these subsets of memes may provide a glimpse into the origins of the human brain and its software. It seems likely that storing experiential-memes and having genetically endowed programs capable of using them as a basis for generating created-memes, would have conferred great evolutionary benefits long before humans arose. For example, as Skinner's famous experiment shows, rats that experience electric shocks, appear to create memes that result in avoidance in the future. (see DTD: *How your brain captures memes*).

As an aside, you may wonder whether the cultural-prenes created by humans (including those stored in this article) are "true". To find out, see DTD: *The gold star of truth*. In addition, while our genetic-prenes have provided our brains with free space wherein future memes can be stored, it appears they have not given the conscious part of our brains direct control of their removal. While our memes may eventually be forgotten, we cannot hasten that process using volition alone. This may have important implications in psychology (see DTD: *How the brain captures memes*).

A PERSON'S CULTURAL-MEME-SET

Now that you have some cultural-memes stored in your brain, what do they do there?

A lot. They will have an immense impact on your physical behavior and emotions.

Consider a professional soldier. The soldier's cultural-meme-set will have specialized cultural-prenes from their nation's cultural-prene-set that most other members do not have in theirs. The soldier may come to store what I'll call the "valor-cultural-prene": that under some circumstances it is honorable to make sacrifices for your fellow soldiers or members of your national society. A soldier who stores the valor-cultural-meme, and strongly believes it, may now be programmed for the ultimate sacrifice in the future. If a soldier's cultural-memes can lead to their death, what have your cultural-memes led you to do?

This example illustrates what members are to a society's cultural-prenes. Your society will have some degree of control over many instruments such as people (whether members or not), weapons, buildings, money, and natural resources. The cultural-prene-set will use these instruments, as best it can, to aid in the survival of important cultural-prenes, even if this results in the destruction or degradation of those instruments.

As an aside, let's take a closer look at prene-sets. Every prene is selfish (see (Dawkins, 1976), DTD: *The selfish prene*). So, a prene-set is a collection of selfish individuals. For example, the set of all the prenes you store, including cultural-memes, experiential-memes, created-memes, genetic-prenes, is a collection of aspiring dictators, each of which wants to exploit you for its own

survival. Your prenes are not a “team”, if a subset of them can get more of your resources by forcing the rest to get less, they will do so “without the slightest remorse”. This causes no end to the difficulty of human existence and the complexity of societies.

There is no requirement that your cultural-memes will be logically consistent. For example, if you are exposed to both religious and secular societies, it would not be surprising if you acquired both anti capital punishment and pro capital punishment cultural-memes. What will you do if asked to vote on capital punishment?

In fact, our brains are full of logically inconsistent cultural-prenes that fight for our behavior. The issues may be minor: should I study or exercise? They may be major: should I put a pet down?

When these fights arise, how will a decision be made?

Perhaps you will think about it, weigh the pros and cons, and then make a decision. But what does “think about it” really mean?

Recall that your brain is a gene-built computer with a gene-built operating system. It seems likely that this operating system includes what I'll call a “prenes legislature” that mediates the prene fights to control behavior.

When you are confronted with a choice of several behaviors, each of your prenes can “argue” in the legislature for the behavior that serves it (not you) best.

The prenes legislature will, in the time allowed before action is required, hammer out a behavior that you will actually enact. During the deliberations, you may experience unpleasant “cognitive dissonance”. When a major issue is involved, your prenes may be at loggerheads, and this dissonance may last for days, disrupt sleep, and make it difficult to concentrate on other issues. Once the behavior you will enact has been hammered out, you may perceive that you have made your decision (see DTD: *The war within*).

CULTURAL-PRENES AND EMOTIONS

Genetic-prenes have long used reward/punishment systems to control the behavior of their organisms. Typically, in humans the rewards are physical pleasures, and the punishments are physical discomforts.

Do memes, and in particular cultural-memes, have a reward/punishment system to control human behavior? It appears that they do. The rewards are pleasant emotions, and the punishments are unpleasant ones.

Here is a simple example.

In America when there is a presidential election nearing, each political party will use its **instruments** to transfer new cultural-prenes into their member's cultural-meme-sets. Typically, among these will be some that will create unpleasant emotions when the opposing candidate is detected. For many people, if the opposing candidate appears on their TV, the unpleasant emotions they experience are sufficiently powerful that, to stop them, the people will take precipitous action to switch to another channel.

This example illustrates that the cultural-memes one acquires are far from static; they are like the apps you add to your mobile phone; once downloaded they can monitor the environment and produce behavior. In humans, the cultural-prenes you acquire can produce emotions.

As an aside, it is worth considering the possibility that emotions evolved specifically to provide memes with a means of controlling human behavior. For more, see DTD: *Cultural-prenes and the perception of emotions*.

THE ORIGIN OF SOCIETIES

Cultural-prenes are to societies what genetic-prenes are to species. In the latter case, Darwin has described the process of variation and natural selection which results in changes in a species' genetic-prene-set. It is the accumulation of these changes over time that eventually gives rise to new species.

The same can be said for societies. For example, we have seen that the cultural-prene-sets of some societies are constantly undergoing changes caused by the exercise of mutational power. Most of these changes are so small we don't take note of them; for example, when a new law is created regarding the use of chemicals in paint. But, on occasion, these changes are quite dramatic; for example, when Octavius modified the cultural-prene-set of Roman society to change it from a republic to an empire. It is the accumulation of these changes over time that eventually gives rise to new societies.

However, as Darwin was aware, there is probably no precise way to define when a species has changed enough that a new species has emerged. Indeed, Darwin went further; he asserted that there is probably no precise way to define what a species is.

*It is really laughable to see what different ideas are prominent in various naturalists minds, when they speak of "species" [...] in some resemblance is everything & descent of little weight—in some resemblance seems to go for nothing & Creation the reigning idea—in some descent the key—in some sterility an unfailling test, with others not worth a farthing. It all comes, I believe, from trying to define the undefinable.
(Darwin, Letter to J.D. Hooker dated December 24, 1856)*

I suspect that Darwin was correct, and that his ideas extend to the origins of societies. We cannot obtain a precise definition of a society or when the changes in a society have given rise to a new society.

Are the pre-war and post-war Japanese societies, merely varieties of a more universal concept of Japanese society, or is the post-war society an entirely new society and the pre-war society extinct?

There is archaeological evidence that Rome has been continuously inhabited since about 800 BCE. Was the Roman society of that time a different one than the Roman society of Augustus's time or were they the same society, but the availability of written and archeological records so limited, that we can no longer detect the "missing links" that demonstrate the gradual morphing of one into the other?

In the end what matters most is to understand the laws that govern how and why evolution occurs in living things and human societies.

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FIGURES

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Figure 1

<http://brandeisspecialcollections.blogspot.com/2013/10/shakespeare-first-folio.html>
<https://www.pinterest.com/pin/hamlets-soliloquy-to-be-or-not-to-be-art-print-60-background-colours3-sizes-shakespeare-play-theatre--366691594669797857/>
Credit: Folio Creations
<https://www.1977magazine.com/shakespeare/>

Figure 2

<https://wallpapercave.com/w/wp7571574>

Figure 3

<https://www.utmb.edu/virusimages/VI/smallpox-variola-virus>

Figure 4

https://en.wikipedia.org/wiki/Rahima_Banu#/media/File:Rahima_Banu.jpg
<https://www.utmb.edu/virusimages/VI/smallpox-variola-virus>
<https://commons.wikimedia.org/wiki/File:Earth-BlueMarble-1997.jpg>
<https://pixabay.com/illustrations/erlenmeyer-atom-lab-experiment-484349/>

Figure 5

https://es.wikipedia.org/wiki/Jane_Wardley#/media/Archivo:Shakers_Dancing.jpg

Figure 6

<https://bozenabooks.blogspot.com/>

Credit: James McWilliams

<https://bestpractices.gsu.edu/best-practices/young-boy-being-tutored-by-his-teacher/>

Figure 7

https://en.wikipedia.org/wiki/Catechesis#/media/File:Jules-Alexis_Muenier_-_La_Le%C3%A7on_de_cat%C3%A9chisme.jpg

Credit: Jules-Alexis Muenier

ABOUT THE AUTHOR

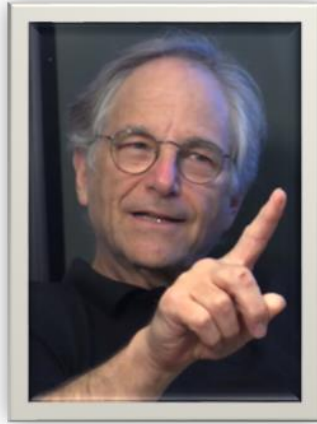


Photo: Heidelberg Laureate Forum Foundation

Leonard Adleman is a former professor of mathematics at MIT and a current professor of computer science and molecular biology at USC. He is the “A” in RSA, a widely used public-key cryptosystem that he co-discovered with Ron Rivest and Adi Shamir and for which they received the Turing Award. He is also known as the father of DNA computing, where computations are carried out by molecules of DNA reacting in solution. He introduced the term “computer virus” for the now familiar computer malware. He has been thinking about a general theory of evolution for over 45 years.