Reconstructing Sub-Saharan, Mayan and Other Prehistoric Civilizations in a Mathematical Macro-Theory of Civilizations

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RECONSTRUCTING SUB-SAHARAN, MAYAN AND OTHER PREHISTORIC CIVILIZATIONS IN A MATHEMATICAL MACRO-THEORY OF CIVILIZATIONS

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I. Introduction

The idea of a civilization is difficult to pin down. Aristotle once said, "I know what it is but when I turn to write it down it eludes me." (Aristotle's "it", of course, did not refer to civilizations.) While it is difficult to come to a commonly accepted definition of what constitutes a civilization, there is broad agreement on the major civilizations in history. As Melko [2002] points out, "There is impressive agreement among civilizationalists on the identity of the major civilizations." Melko then proceeds to identify the major civilizations and analyze the components that make up a civilization "summing up areas of consensus and disagreement."

My point of departure for this essay is a major conclusion of Melko's analysis: "Do civilizations have meaningful internal relationships? Can they be said to be integrated? Yes, unquestionably." My view is simply that civilizations have an overall state that includes the political, economic and cultural spheres with perhaps some lags and leads in individual parts.

As illustrations of this concept of overall state consider the Roman Empire towards the end of its days when talk of "cosmic senescence" was common and the Empire faced plagues, invasions, adverse weather, crop failures, labor shortages, and an overall feeling that the end was approaching. Consider also a contemporary example: the United States after 2000 – an economic disaster in the financial markets that has influenced practically every aspect of American life – funding shortfalls for cultural activities, universities and governments; a decline in the middle class and working class – especially in attitude ("Who really thinks life is getting better?") – unseen since the Great Depression; and a change in the world geopolitical situation from American super-dominance in the 1990's to a dangerous world of terrorists, nuclear proliferation and a potentially explosive Middle Eastern situation. All this in a period of
a few years.

In both the Roman and contemporary examples we see a type of massive civilization-wide shift in world-view that tend to confirm that a civilization has a significant degree of integration. It evokes Shakespeare’s image of a “tide in the affairs of men.”

Based on this view we have created a mathematical model of a civilization that subsumes the state of a civilization in a single number or index, realizing that there are important details in the individual components of a civilization that the index does not capture. The index provides a “macro” indicator of the state of a civilization. The “micro” indicators for the components of a civilization are not captured in this index. The closest analogy to this approach is provided by the respective roles of macroeconomics and microeconomics in describing the evolution of a large financial entity such as a nation.

We begin by assuming an operational definition of a civilization as a large, long-lived social entity that conforms to the general nature of the civilizations and resides in the commonly accepted set of civilizations. While this definition leaves many details and some major features “up in the air,” and is somewhat circular, it enables us to develop a viable theory that we can compare to “experiment” (history).

We have developed a mathematical theory of civilizations and applied it to known civilizations with excellent results. The theory begins with Toynbee’s well-known three and a half beat pattern for civilizations—a period of growth, followed by a breakdown (an “event” marking the end of growth), followed by cycles of rout-rally-rout-rally-rout-rally-rout. He observed that civilizations last for approximately a thousand years in general (barring catastrophes) with a four hundred year “Time of Troubles” and a four hundred year universal state. The “Time of Troubles” period typically has a “rally” and the universal state period typically has a “rout”.

These observations formed the starting point of the mathematical theory of civilizations. Let us imagine drawing a diagram of these routs and rallies plotted against time.

Since most readers of this article have happily forgotten much of their high school algebra let us begin by thinking of the chart of a patient in a hospital with a nurse plotting the ups (rallies) and downs (routs) of a patient’s temperature each day. It would look something like the displayed temperature chart.
Each circle is the temperature reading for that day. We are thus plotting temperature versus time. Now let us look at Toynbee’s pattern for civilizations: growth–rout–rally–rout–rally–rout–rally–rout. The repetitive pattern of routs and rallies suggests a cyclical or oscillatory phenomenon – a pattern that has been suggested by various historians since at least 500 BC.

A mathematically inclined person would immediately think of oscillatory patterns such as pendulums, bells, and so on that are described as “harmonic motion” – the word harmonic coming from music originally – harmony. If the observation of Toynbee, and other historians, of regularities such as four-hundred year “times of trouble” and four-hundred year universal state periods is correct as it generally seems to be, then harmonic motion (which has a regular beat pattern) furnishes a mathematical picture – graph – of the routs and rallies. (Figure 1 depicts the regular pattern of routs and rallies but has additional detail since the rallies have a declining height as time progresses and the routs are similarly less pronounced with time. We will discuss these points later.)

The first question that we address is “What is ‘rallying and rout-ing’?” If we were discussing the stock market where this terminology originated, it would be a representative stock market index such as the Dow or S&P 500. But in the case of civilizations there is no existing index. And the index for a civilization cannot be financial since a civilization incorporates so many other cultural and political aspects.

So we must define an index for the overall state of a civilization and then address the issue of how to measure it. We define an index that we call the “societal level.” This index is a measure of the health of a civilization in a way that is analogous to the way that a stock index measures the health of the market.
The societal level is a qualitative measure or index. Thus its definition is necessarily imprecise. In my book, *The Life Cycle of Civilizations* [Blaha, 2002], we characterize it in the following way:

\[ S = \text{Societal Level} = \text{the strength of a civilization in terms of political and social institutions, social cohesion, ability to innovate to solve social problems, capacity for technological innovation, flexibility in finding solutions, enterprise in meeting challenges.} \]

The societal level is a measure of the inner development and inner strength (the psyche) of the people of a civilization. Historical events, social conditions and material conditions reflect the societal level in the sense that they are the symptoms that measure its state just as a doctor measures the health of a patient by the patient’s symptoms. Historical events are the symptoms of the “health” (societal level) of a civilization.

Thus, naive ideas that size, wealth, power, size of armies, and so determine the health of a civilization are not correct. And in our view the study of the causes of events in the case of civilizations is misleading. Some individual events can be singular (such as the temporary Gothic conquest of Rome in the first century AD). But the long-term pattern of events is determined by the societal level. The thesis of our approach is that the course of a civilization is more determined by the inner strength of the people than by external factors except in the case of overwhelming events such as natural disasters or an invasion by forces with an overwhelming technical advantage. The inner strength and cohesion of the people determines the health of a civilization over the long term. Examples abound: Rome, the Greeks vs. the Persians and so on.

It would be possible in principle to develop a “societal level survey” along the lines of consumer sentiment surveys that would measure the societal level based on the “average” responses of a statistically significant sample of the people of a civilization. However, the determination of the questions on the survey and their mapping into a societal level number are difficult issues. And the success of the survey approach can only be verified by applying it to multiple civilizations over a period of 500 to 1000 years or more. Thus substantial difficulties attend the survey approach.

If we plot societal levels, good events should appear during rising parts, and peaks, of the societal curve. A good event(s) also usually
II. Nature of the Theory

The theory that we developed was in part based on Toynbee's (and other historians') observations:

A. The 3 1/2 rout and rally pattern.
B. The 400-year length of both the "Time of Troubles" and "Universal State" periods,
C. The appearance of a rally in the "middle" of a Time of Troubles and of a rout in the midst of the Universal State period.
D. The duration of routs and rallies are of roughly equal length which Toynbee sees as four generations of Mankind.

From these assumptions we can calculate the length of a cycle [Blaha, 2002]:

E. If we consider the cyclic pattern implied by B and C we see that the Time of Troubles consists of a rout followed by a rally followed by a rout or 1-1/2 cycles. If 400 years is 1-1/2 cycles then simple mathematics shows the length of a cycle is 400/1-1/2 = 267 years approximately. Similarly a universal state period is a rally followed by a rout followed by a rally — also 1-1/2 cycles — leading to the same 267-year period for each cycle.

F. Since a cycle consists of a rout and a rally (or a rally and a rout), the length of both a rally and a rout is roughly 133.5 years. If a rout or rally takes 133.5 years and consists of four generations of Mankind then the length of a generation is roughly 33 years — a value that is consistent with the usual historical length of a genera-
tion. Historians often take the length of a generation to be thirty years.

G. The regularity of these cycles establishes a harmonic oscillator (pendulum) cyclicity for civilization.

To the above observations and calculation we add the following assumptions [Blaha, 2002]:

H. The growth period for a civilization is short – approximately 134 years – one half of a cycle to conform to the cyclic pattern of the periods that follow in the civilization. Many civilizations show initial growth spurts after (often long) periods as static societies. Some familiar examples are Greek civilization, Egyptian civilization (100 years of large pyramids), and modern Japanese civilization 1868 – 1985 — a 117-year transition from medievalism to the second greatest economy in the world.

I. The magnitude of routs and rallies declines as a civilization evolves. The first peak at the end of the initial growth period has the highest societal level. The civilization is united and has scored a great triumph. The health of the civilization is at its peak. Succeeding peaks decrease because the intervening routs have diminished the cohesion of the society and led to divisions between the large groups within the society. When the civilization was in the growth phase all worked towards a common goal: survival, religious, and so on. In a diverse society that is enjoying the fruits of its growth period the original unity is lost. The classic example is Greek civilization, which after the defeat of the Persians entered a period of rout with the breakup of the Peloponnesian League. Succeeding routs are less severe with time because of the accumulation of unifying cultural values (and perhaps a form of “patriotism”).

J. The civilization at its end is at a higher level than the civilization at its beginning before the growth phase began. There is an accumulation of cultural and societal baggage that exists at the “end” of a civilization. For example, at the end of the Roman Empire in the fourth century the barbarian conquerors allowed life to continue as before even to the extent of using Roman law and courts. They reserved only the army and rule for themselves.
Items E, F, G, and H suggest a simple harmonic oscillator picture. Civilization would then swing back and forth between routs and rallies **of the same size** (amplitude) like a clock pendulum for 3-1/2 cycles plus the growth period and then abruptly end.

This type of behavior is not natural for a pendulum nor is it natural for a civilization. Item I provides a more natural evolution. Just as the amplitude (swings) of a real pendulum decrease with time due to friction so that the pendulum eventually comes to a halt, item I implies the swings (routs and rallies) of a civilization eventually "grind" to a halt after 3-1/2 cycles. This type of behavior is mathematically represented by a "damped harmonic oscillator." So we have to add social "friction" to my theory in just such a way as to bring the routs and rallies to a halt after 3-1/2 cycles.

Lastly, item J introduces another important modification. The state of the civilization at its end should be greater than the state at the beginning (barring overwhelming catastrophes.) As a result we have to define my theory for the societal level of a civilization so that it is the sum of all the past history of the civilization as represented by the oscillations in the societal level during the history of the civilization. Mathematically this means the current societal level is an integral of all the past changes in the societal level since the beginning of the growth phase.

The result of items A through J is a mathematical description of a 3-1/2 beat civilization embodied in the equation for the societal level $S(t)$:

$$S(t) = \frac{[1 - e^{-0.00281t} (0.12\sin(0.0235t) + \cos(0.0235t))]}{0.0235}$$

where "t" is the time measured in years since the start of the growth period of the civilization. The start of the growth period is 134 years (approximately) before Toynbee's breakdown point for the civilization.

Figure 1 shows a plot of $S(t)$. Some important points to note are:

1. Since the value of the societal level cannot be experimentally measured only *relative* values of $S$ are meaningful. Thus $S$ at the peak of a rally is greater than $S$ at a low point after a rout.

2. The choice of parameters leads to a pattern of routs and rallies having 3-1/2 beats before they become negligible.
3. The societal level at the end of a civilization is always roughly the level at the midpoint of the initial growth period. Thus my theory contains Spengler's intuition that the cumulative state of a civilization is implicit in the beginnings of the civilization.

4. The civilization ends with $S$ becoming level (a static society) but at a higher level than the initial static society (prior to the growth phase;)

![General Pattern of a Civilization's Life Cycle](image)

*Figure 1. The basic 3-beat Toynbee pattern as represented by the plot of the societal level in my theory.*

Figure 1 shows the evolution of a civilization without a successor and without substantial effects from contacts with other societies.

We have extended the theory [Blaha, 2002] in many ways including:

1. The effect on societal levels due to the interaction between a civilization and other societies (civilizations and barbarian societies) with good agreement with historical data on such interactions. (We use coupled integro-differential equations.)

2. The evolution of the societal level in a region with a series of
successor civilizations.

3. The effect of changes in human society (technology and longer lifetimes) on societal level.

It would be impossible to describe these features within the space limitations of a journal setting. The interested reader is referred to Blaha [2002], which contains these discussions as well as plots of forty-one civilizations comparing the theory with historical data. The match is extremely good for all analyzed civilizations: Asian, Mid-Eastern, European, African and American civilizations.

III. Application to Pre-historic Civilizations

After scientists develop a theory they often apply the theory to experimental data that previously was without any recognizable form and then they find that the "formless" data fits the pattern of the new theory. Similarly, an artist will often see meaning, form and beauty in a scene that an ordinary person would view as formless or without interest. The artist’s inner vision – the artist’s “theory of beauty” – leads the artist to recognize beauty and form where others might not. Modern Art in particular is often strongly based on the artist’s inner vision.

The mathematical theory of civilizations that we have developed also has the capability of providing a framework with which to examine historical data. Therefore we will see that we can use the theory to give form to little-known periods of prehistory. These periods of prehistory have no written language and thus what we know of these periods is based on oral records recounted by later generations of historians, or based on archaeological evidence. Many of the oral records can be viewed as “legendary.” Nevertheless we will seek the mustard seed of truth in these oral accounts and legends using my theory as the winnowing agent.

We have also applied this technique to periods such as Carolingian times and Biblical times, and found recognizable patterns of civilizations in periods Toynbee viewed as interregnums. We found the placement of a civilization between Hellenic civilization and Orthodox Christian (main body) made sense when we examined events in the Eastern Roman (Byzantine) Empire. We called this “new” civilization Byzantine civilization.

Similarly the placement of a civilization between Syraic civilization and Iranian Islamic civilization also seemed to make sense and be in accord with historical data. This “new” civilization which we call
Iranian civilization started in 312 BC and was based on a fusion of Hellenic and Iranian culture. Its historical events matched the routes and rallies in the societal level of the theory.

In addition we found historical support for a “new” civilization in Palestine starting in 107 AD that we call JudaeoPalestinian civilization, and an Early Hindu civilization starting in 80 AD. All of these civilizations show a pattern of historical events that follows the routes and rallies of my theoretical societal levels.

IV. Some Prehistoric Civilizations

Through the use of my theory we can provide an intellectual framework within which to understand these civilizations, and provide guidance to archeologists and historians at work in the field on uncovering the civilizations.

The first generation civilizations that Toynbee was aware of had the good fortune to have a written language in which their history has been at least partially recorded. We think particularly of the Sumeric, Egyptian and Sinic civilizations in this regard.

Both the Egyptian and the Sinic civilizations have writings referring to an earlier stage in their civilizations, or a predecessor civilization, that existed prior to the known civilizations with which we are familiar. These periods were more or less prior to the development of writing.

Some Egyptian and Greek historical records describe a period of civilization with a united Egypt under the Pharaoh Menes in 3000 BC. While we often think of Egyptian civilization as suddenly flowering from nothing, and then the immediately building of the pyramids, there is a long prior period during which the Nile Valley was brought into cultivation, and societies and governments developed. This prior period encompassed the 0th and 1st Dynasties. It included the legendary kings: Ka, Narmer, Aha, Djer, Djet, Den, Anedjub, Semerkhet, Qa’a

King Narmer appears to be the king who united Upper and Lower Egypt based primarily on a shield-shaped sculpture called the Narmer Palette that has been dated to 3150 – 3125 BC. The front side of the Narmer Palette shows Narmer wearing the White Crown of Upper Egypt in the act of striking an enemy from the marshlands. The rear side shows Narmer wearing the Red Crown of Lower Egypt (the Nile delta) as he inspects the bodies of headless enemies.

In the period from 3500 BC to 2600 BC, Egypt evolved from two
separate regions, Upper Egypt with strong African influences and Lower Egypt (the Nile delta region) with strong Libyan and Middle Eastern influences, into one united kingdom. The building of the great pyramids that followed reflected the wealth and power of a united Egypt. This later Egypt was the Egypt of Egyptaic civilization.

But the prior one thousand years contained an Egypt of various states created during and after the taming of the Nile Valley. It also developed a universal state that existed for about four hundred years before the beginning of Egyptaic civilization (which we have set for good reason at 2557 BC.)

The only other important "known facts" of the thousand years of this prehistory are:

• A major (unspecified) calamity took place in the reign of King Semerkhet around 2800 BC;
• An upheaval appears to have happened during the reign of King Qa'a; and
• A major rivalry existed between the cults of Set and Horus around 2725 BC.

Although the data on Egyptian prehistory is somewhat sketchy we can use my theory of civilizations to develop a picture of that civilization based on any one of the following dates:

1. The beginning of the time of troubles
2. The end of the time of troubles
3. The beginning of a universal state
4. The end of a universal state

Any one of these data items fixes the S curve (the societal level curve) for the civilization. Any other information that we have on the civilization can then be used to check the routs and rallies of the S curve to confirm its validity.

Similarly we can examine the information in early Chinese writings referring to prehistoric dynasties and empires from the period before the recognized beginning of Sinic civilization. Again only one date is necessary to fix the S curve for a possible pre-Sinic civilization.

We do not expect that many more unknown civilizations will be uncovered in view of the beginning of climatic conditions favorable for civilizations only 10,000 years ago and the need for some time after that point for the growth of agriculture and the growth of population levels necessary for civilization. However, if evidence of additional civilizations is found, then my theory offers a way to set up a time framework
for the evolution of a civilization with minimal data input: namely one of the above mentioned four dates.

V. A Prehistoric, Unrecognized Egyptian Civilization?

The Narmer palette showing Narmer wearing the White Crown of Upper Egypt and the Red Crown of Lower Egypt is believed to indicate that Narmer united Upper and Lower Egypt into a universal state. Other historical data indicates his central importance. Since the Narmer Palette has been dated to 3150 – 3125 BC we have chosen 3157 BC as the beginning of the universal state of a prehistoric civilization that we will call Nile River civilization.

Figure 2. Societal Level curve of Nile River civilization.

Allotting 400 years for a time of troubles and 134 years for a start-up growth phase we arrive at a beginning date of Nile River civilization
of 3691 BC. We use the standard theory of a civilization to obtain the societal curve shown in Figure 2.

The Semerkhet Calamity and the Qa’a Upheaval appear at a low point of the theoretical societal level. Also, the rivalry between the Set and Horus cults appears on the slope of a downturn in the societal level. Thus there is a correlation between known historical events, and the routs and rallies of the societal curve. As further archaeological data surfaces, more detailed tests of the S curve of the Nile River civilization will be possible.

VI. A Prehistoric Unrecognized Chinese Civilization?

Chinese writing matured during the waning years of the Shang Dynasty around 1400 BC to 1200 BC. Prior to that time we have pictographs and early Chinese characters—many of which are not known, or imprecisely known, in terms of modern equivalents.

Chinese prehistory is not well documented. Some Chinese classics describe legendary figures and historical events of the period before 1000 BC. Some of these works appear to contain passages that are forgeries from later times. Generally Western historians have viewed historical accounts of these early times with suspicion.

Hints of an Early Chinese Civilization

However, recent archaeological finds have been changing the view of Western historians. The Shang Dynasty period from 1766 BC to 1123 BC was viewed as mythical until recent archaeological discoveries confirmed the existence of this dynasty and its place in the history of China. The earlier Hsia Dynasty (usually thought to last from 2205 BC to 1766 BC with some proposing the alternate period of 1994 BC to 1523 BC) has been radiocarbon-dated to 2100 BC to 1800 BC in relatively recent archaeological studies of its capital city.

An examination of the culture and events of China between 3000 BC and 1000 BC suggests that a civilization existed in the Yellow River region which we will call the Yellow River civilization. The sophistication of the Shih Ching (the “Book of Songs”) which dates to before 1000 BC confirms the existence of a lengthy, previous cultural tradition. We will now summarize the known events and features of the period before 1000 BC that suggest an unrecognized civilization existed in that period.
Chinese History from 3000 BC to 2205BC

Chinese history in this period has a mythological flavor but probably is based, at least in part, on historical fact. There are two phases in this period: the period of the three cultural heroes and the period of the three sage kings. The center of cultural development was the Yellow River valley. The climate of the valley at this time was warmer and more moist than the present climate of this region. Swamps and lakes were more common.

The three cultural heroes were three great kings who were prominent in a period of significant cultural development. They were accorded credit for the cultural and technological progress of the period. These great kings who lived between 2800BC and 2600 BC are:

- Fu Hsi – He taught men how to hunt, fish, and cook.
- Shen Nung – He developed the cultivation of the five grains, invented the plow, and established markets (a mercantile economy).
- Huang Ti – He invented boats, oars, and the fire drill. He cleared the plains with fire so crops and cattle could be raised. He encouraged his court to cultivate music.

The three sage kings of this period were Yao, Shun, and Yu. These kings were celebrated for their wisdom and virtue. The approximate date of their activity is:

- Yao – 2350 BC
- Shun – 2250 BC
- Yu – 2205 BC

Emperor Yu, who drained the land so that it could be cultivated, is reputed to have created the mountains and founded the Hsia Dynasty in 2205. Most Western historians view the period up to the founding of the Hsia Dynasty as mythological. Yet the fact remains it was a period of major cultural growth as well as major advances in agriculture.

Chinese History from 2205 BC to 768 BC

This period can be viewed as composed of three parts: the Hsia Dynasty (2205 BC – 1766 BC, or alternately 1994 BC – 1523 BC), the Shang Dynasty (1766 BC – 1123 BC, or alternately 1523 BC – 1027 BC), and an interregnum (1123 BC – 768 BC, or alternately 1027 BC –
768 BC) started by a successful invasion of King Wu of Chou (the leading march or frontier state).

The Hsia Dynasty was founded by the sage Emperor Yu in 2205 BC in an inland portion of the Yellow River valley. Historians had viewed this dynasty as mythological until excavations in 1959 in the city of Yanshi uncovered what appears to be the capital of the Hsia Dynasty. Radiocarbon dating of artifacts at the site showed they dated from 2100 BC to 1800 BC.

The Hsia Dynasty existed until the reign of Emperor Chieh, reputedly a decadent emperor, who was overthrown by the wise and virtuous Emperor T’ang who founded the Shang Dynasty in 1766 BC.

The Shang Dynasty is noted for the invention of Chinese writing. Some of the noteworthy events and features of the Shang Dynasty are:

- The Dynasty had a number of capitals until Emperor Pan moved the capital permanently to Yin (near modern Anyang) in 1401.
- The Dynasty developed a highly organized bureaucracy.
- Bronze casting reached a peak of perfection during the later years of the Dynasty.
- The religion of this period combined ancestor worship with the worship of a supreme god Shang Ti (“Lord on High”) who presided over the lesser gods.
- Between roughly 1500 BC and 1100 BC Chinese writing underwent a transition from pictographic writing (pictures representing words) to Chinese characters similar to modern Chinese characters. Many of the Chinese characters of those times are not known today.
- The boundaries of the Shang Empire at its peak were the Pacific Ocean on the East, Shensi on the West, southern Hopeh on the North and the Yangtze on the South.

The Shang Dynasty ended in 1123 BC. There was a great drought in the reign of the last Shang emperor, Ti-hsin, that probably weakened the dynasty significantly. King Wu of the leading march state, a vassal on the frontiers of the empire, staged a successful revolt and invasion in 1123 BC conquering the empire. Wu started the Chou Dynasty that also appears at the beginning of the Sinic civilization.
The period between the fall of the Shang Dynasty (1123 BC) and
the beginning of the Sinic civilization (768 BC) was an interregnum.
This period contained about 1773 feudal fiefs engaged in constant war-
fare. It is similar in character to the feudal period of European history.

**A Yellow River Civilization**

The Hsia Dynasty lasted for approximately 400 years. The Shang
Dynasty lasted for approximately 600 years. The length of these periods
and the advanced state of their culture strongly suggest that a significant
civilization existed.

We will apply my standard theory of civilizations to the Yellow
River civilization and set the end of the civilization’s universal state to
the end of the Shang Dynasty in 1123 BC. With this choice the begin-
ning of the civilization (the startup) is 2057 BC – a date that is consist-
tent with the radiocarbon dating of the Hsia Dynasty to 2100 BC.

Remarkably the beginning of the universal state is 1553 BC and the
time of troubles period lasts from 1924 BC to 1523 BC – these dates are
remarkably similar to the dates that some modern scholars specify for
the Hsia Dynasty (1994 BC to 1523 BC) and the Shang Dynasty (1523
BC to 1027 BC). With a startup date of 2057 the dates are consistent
with radiocarbon dating of the Hsia capital artifacts at Yanshi.

**VII. A New View of Chinese & Egyptian Civilizations?**

The analysis we have performed on prehistoric Egypt and China
strongly suggests that unrecognized prehistoric civilizations existed in
those countries. In my view the list of Egyptian and Chinese civiliza-
tions is:

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<thead>
<tr>
<th>Chinese civilizations:</th>
<th>Yellow River</th>
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<tbody>
<tr>
<td>2057 BC – 1123 BC</td>
<td>Sinic</td>
</tr>
<tr>
<td>768 BC – 172 AD</td>
<td>New Sinic</td>
</tr>
<tr>
<td>172 AD – 878 AD</td>
<td>Far Eastern (main body)</td>
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<tr>
<td>878 AD – 1853 AD</td>
<td>SinoTechnic</td>
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<tr>
<td>1950 AD – 2884 AD</td>
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<tr>
<th>Egyptian civilizations:</th>
<th>Nile River</th>
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<tr>
<td>3691 BC – 2757 BC</td>
<td>Nile River</td>
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<tr>
<th>Egyptian civilizations:</th>
<th>Egyptaic</th>
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<tr>
<td>2557 BC – 500 AD</td>
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The application of my theory to other potential lost civilizations that may be uncovered as archaeology progresses can help to expand our understanding of these forgotten civilizations.

VII. Reconstructing Mayan Civilization

Recently, new Mayan hieroglyphics were accidentally found in Dos Pilas, Guatemala that describe a series of events and wars between the Mayan “superpowers” Tikal and Calakmul. These historical findings [Williams, 2002] appear to support my new mathematical theory of civilizations. Previously Mayan history was viewed as a collection of random wars between city-states that ended around 900 AD in a mass exodus from the cities. It now appears that Mayan civilization was
undergoing a pattern of development that is similar to the pattern of development of Eurasian civilizations.

If we apply the standard societal level curve to Mayan civilization we need to set only one parameter – the point where the civilization began its rise. We set the beginning of Mayan civilization to 223 BC. Prior to that year we view Mayan society as largely static. Figure 4 shows the plot of societal level with known events of Mayan history (including the new hieroglyphic data) identified. There appears to be good agreement with the historical data.

A series of major wars between Tikal and Calakmul, Mayan superpowers, in the fifth through seventh centuries appears to have brought Mayan civilization to its knees. Recently unearthed hieroglyphics describe phases of this war such as the founding of an important military outpost (stronghold) Dos Pilas by Tikal in 629, its conquest by Calakmul around 650, its emergence as a powerful state that conquered its founder Tikal around 660, and its eventual abandonment in 760. Thus a sequence of what originally appeared to be local conflicts between 600 and 700 was, in reality, a continuation of a “world war” between Tikal and Calakmul that culminated in the conquest of Calakmul in 695 by Tikal.

The roughly 250 years of warfare between Tikal and Calakmul lasting from the fifth through seventh centuries corresponds to the 267 year cycle found in Western civilization, and Middle Eastern and Asian civilizations, and embodied in my theory.

Mayan civilization began with a roughly 134-year period of major growth starting around 223 BC. Great cities were built such as El Mirador. Teotihuacan was also founded in the first century BC. Mayan civilization then went through three and a half cycles of ups and downs just like Eurasian civilizations. The last cycle was dominated by constant wars between Tikal and Calakmul that culminated in the decline of Mayan civilization. Tikal’s conquest of Calakmul around 700 AD started the last stage of decline that ended in the complete abandonment of the Mayan cities around 900 AD. The last stages of the decline of the Mayans can be compared to the last stages of the decline of Rome: constant warfare with Barbarian invaders culminating in the conquest of Rome and the reduction of Rome to a small agricultural village among splendid ruins.

Thus the spectacle afforded by Mayan history compares with that of European and Asian civilizations and confirms that the evolution of
civilizations is based on our common human nature.

As Figure 4 shows, overwhelming fratricidal warfare between states weakened the strength of the civilization in the period from 445 - 575 AD. The period between 580 and 700 shows an upturn in the civilization that is probably due to a lower level of conflict that allowed the civilization to begin growing again. The settlement at Dos Pilas in 629 and its growth into a major power support the notion that the Seventh Century was a period of growth.

The emergence of a “winner” – Tikal – in 695 with the conquest and destruction of Calakmul roughly marks the high point of the period.

The period denoted “Time of Troubles” was probably a period of fierce conflict between the city-states. In Eurasian civilizations it is normally a period of ruinous conflict.

The period denoted “Universal State” normally is a time in the life of a civilization where the civilization is dominated by an empire. In the case of Mayan civilization this time may actually have been a time dominated by a confederation of states that often had internal wars. It may have been analogous to the Parthian Empire, which consisted of loosely united, more or less independent provinces.

The history of Teotihuacan appears to follow the general pattern of Mayan civilization. It was founded during the period of great initial growth, reached its peak shortly after a peak in Mayan civilization and collapsed at roughly the same time as Calakmul was conquered. Recent evidence suggests that the ruler of Tikal in the fourth century came from Teotihuacan. So the entire region from Teotihuacan east to the Mayan heartland appears to have strong interconnections.

An interesting detail of Mayan civilization is the Mayan view of history as occurring in 400-year epochs called “baktuns”. This view evokes Toynbee’s notion of 400 periods in the history of civilizations. The eighth baktun according to the priests of Tikal ended in 435 AD and the ninth baktun ended in 835 AD. Figure 4 of my theory shows a peak at 445 AD and a small final rout in 845 AD before the abandonment of the Mayan cities – a rather close coincidence of dates.
VIII. A Sub-Saharan Civilization

There is little concrete data available on Sub-Saharan civilizations because much of their history is based on oral traditions rather than writings. Another difficulty is the general isolation of these civilizations from Middle Eastern, Asian and European civilizations primarily due to geographical reasons.

One Sub-Saharan civilization that does have some solid data [Gazlake, 1973] on its history available is the Great Zimbabwe civilization that lasted approximately from 500 AD to 1600 AD. While there are no known oral or written historical records of this civilization there are impressive ruins of a large city (now known as Great Zimbabwe) between the Limpopo and Zambezi rivers east of the Kalahari Desert that show the magnitude of this civilization. Shona-speaking people started moving into the valley containing this city about 500 AD.

The country was capable of supporting a sizable population…
through livestock and farming. However the main reason for the development of the city and civilization of Great Zimbabwe appears to be gold. The city, unlike most cities, was not located on one of the rivers in the area. Instead it appears, in one view, that it may have been located on top of a rich gold deposit. The gold furnished the money needed to build the city and to import goods from other parts of Africa and also from India to some extent.

On the other hand, some archaeologists believe that the economy and power of Great Zimbabwe may not have been founded on gold mining. Great Zimbabwe lies on the routes from gold-producing regions and Indian Ocean ports such as Sofala, Mozambique. African gold and ivory was traded for beads, cloth, and other goods. For example, Celedon pottery from the early Ming Dynasty was one of the most common imports found at Great Zimbabwe. From 1000 AD onwards Zimbabweans had access to Indian, Chinese, and Persian imports.

The purpose of the city with its massive walls of up to 32 feet in height and sometimes reaching seventeen feet in width may have been to protect gold and to act as a religious center for the worship of Mwari, their god, who they viewed as the creator and sustainer of life.

The most important of the Great Zimbabwe ruins is the “Elliptical Building” – a building with a circumference of roughly 800 feet and a diameter of up to 293 feet. Together with surrounding ruins it covers an area of roughly 1800 acres. Part of the purpose of the building may have been to act as a smelter and repository of the gold extracted from the mine beneath. It appears that up to 20,000 people may have lived in huts outside the Elliptical Building.

Major growth in trade led the Zimbabweans, the Mwenemutapa, to centralize their government. Originally they had ruler-priests. As they rose to empire the Mwenemutapa transitioned to a military kingly government that became the greatest empire south of the Sahara.

The currently known chronology of the Great Zimbabwe civilization is:

• Arrival of Shona-speaking people: 500 AD
• Mwenemutapa or Monomotapa Empire: 1000 AD – 1400 AD
• Great Zimbabwe city constructed from 1250 AD – 1400 AD
• End of Great Zimbabwe civilization: 1500 AD
• First mention of Great Zimbabwe City by Europeans: 1531 by Captain Vicente Pegado, of the Portugese Garrison of Sofala, Mozambique.
If we take my standard societal level curve and apply it to the Great Zimbabwe civilization we need to set only one parameter – the point where the civilization began its rise. We set the beginning of the Great Zimbabwe civilization to the approximate arrival time of the Shona-speaking people, 500 AD. The known events of the history of Great Zimbabwe are in good agreement, as shown in Figure 5.

The fact that the known features of this relatively isolated culture conform to the theory of civilizations strengthens the belief, expressed in Blaha [2002], that we have found a fundamental multi-generation social feature of human societies based on a subtle combination of genetic components in the makeup of modern mankind.

Figure 5. The societal level of the Great Zimbabwe civilization compared to the known events in its history.
IX. Conclusion

The application of my general theory of civilizations appears to be consistent with the known facts of these prehistoric civilizations. [Note added in proof: The known chronology of events of the Caral-Casma-Supe Valley civilization of Peru that built pyramids of the scale of the great Egyptian pyramids starting in approximately 2627 BCE is also consistent with my general theory of civilizations, as will be discussed in a forthcoming note.] Thus my theory appears to be a tool for the analysis of these civilizations. As archaeologists and historians piece together new data, the theory provides a means of organizing the data and creating an overall perspective of the history of each prehistoric civilization. In addition, new data will provide new tests of the scope and validity of this theory of civilizations.

In addition to showing the general validity of the theory, Blaha [2002] also applies the theory to apparent civilizations showing a continuity in the successive civilizations of regions; extends the theory to describe the interactions of civilizations with each other, and also with "barbarian" societies; and develops models of the effects of an industrial revolution on a civilization based on the theory. It also accounts for arrested civilizations such as Eskimo civilization.

The generality and success of the theory seems to be based on inherent four-generation trends in Mankind totaling approximately 134 years – the length of a rout or a rally. These types of trends appear to be present in all branches on Mankind on all continents. The only way that we can understand the universality of the four-generation effect is to postulate a genetic origin involving a complex combination of genes that establish multi-generational social/psychological trends. The origin of this complex behavior pattern must lie in some ancient competitive advantage that selected in its favor – perhaps tied to weather patterns.

It is interesting to note that a major branch of psychiatry – Jungian psychiatry – postulates the existence of certain common patterns of ideas and symbols in individuals called archetypes. In our present discussion we see a common, long-term social behavior in masses of mankind called civilizations. The similarity is evident.

In the beginning of this paper we noted that the definition of civilization was an area of controversy. After seeing a common pattern that can be mathematically quantified the question arises: Can we use this pattern as a defining feature of a civilization? Certainly it is operationally well defined. Naturally we would add other qualifying features as
well to frame a working definition of a civilization.

Bibliography

