Cliodynamics: the Journal of Theoretical and Mathematical History

Seeing the Forest of Secular Cycles

David J. Sirag, Jr.

Turchin (2006) presents a model of cyclic human behavior that can be mapped onto data from historical periods to explain some of the reasons behind these events. This report describes a database for representing these maps between specific instances of the secular cycle model and high-level descriptions of many of the world's historical empires. The initial use of this database provides a strategic look at one possible interpretation of well-known historical events. It is hoped that this initial mapping will act as a baseline to be enhanced by more detailed research. In addition, when viewed at this strategic level this mapping suggests a refinement of the Secular Cycle model based on a regular shortening of the periods of these cycles over the full imperial cycle and over the general course of human history.

Introduction

In *War and Peace and War* Peter Turchin (2006) offers the following generalization: "A life cycle of a typical imperial nation extends over the course of two, three, or even four secular cycles… Thus, several secular cycles are nested within the great cycle of the rise and decline of asabiya." I was intrigued by the thought that large-scale dynamics of history might be caused, or at least described, by cyclical processes resulting from reasonably mechanistic social interactions. The book provides a variety of examples from history as illustrations of the concept and uses detailed data to show the mechanisms by which these social interactions produce the observed data. My first response to these examples was to compare the cycles described against my own superficial knowledge of these periods. Next, however, my curiosity led me to wonder if these cycles were universal, or only applicable to select periods of history.

I knew I could not recreate the detailed analyses that were the basis of Dr. Turchin's books, but I thought that I should be able to see evidence in even the coarsest descriptions of human history. I decided to map the large-scale dynamics of human history using the Secular Cycle model as the assumed structure. In order to make the resulting volume of data more accessible I have created a database to record the events used in my study and the parameters of the secular cycles implied by those events. The database has made analysis of these data more tractable. By making this database available to others I hope to facilitate more detailed research that will support, refine, or provide alternatives to the baseline mapping. This report describes the general structure of the database, the methodology used to create the baseline dataset,

Corresponding author's e-mail: siragdj@comcast.net

Citation: Sirag, David J. 2012. Seeing the Forest of Secular Cycles. *Cliodynamics* 3: 294–305.

some initial analysis of the data, and some questions that it poses for future research. I have found that this database helps provide a strategic perspective to discern the characteristics of the forest of secular cycles without being tangled up in the details of the individual trees.

Database Structure

The basic unit of time used in the database is the *generation*, defined to be roughly 25 years. As described in numerous sources, a *fathers and sons cycle* is a generally disruptive period in which conflict-filled, declining generations (shown in black) alternate with relatively peaceful, growth generations (shown in white) where sons avoid repeating the wars of the fathers. In diagrams too large in scale to show individual generations the entire fathers and sons cycle is colored gray. An *integrative phase* (colored green) is a period of prosperity and growth. I will refer to one integrative phase immediately followed by a fathers and sons cycle as a *secular cycle*. In addition I must introduce a new term, a *formative phase* which indicates the initial period in which the growth of an empire is triggered, before it enters the global stage. These formative periods are colored yellow. I will define an *imperial cycle* as one formative phase followed by some number of secular cycles in the same geographical/national setting. I believe this imperial cycle is equivalent to the "great cycle of the rise and decline of asabiya" described by Turchin (2006). I have named each of the imperial cycles and secular cycles that I have identified. Not too much meaning should be read into these names since the cycles do not always coincide exactly with the more traditional periods of the same name. In fact I had significant difficulty naming the imperial cycles since they provide a different perspective from the traditional ones used in books and taught in school. In most cases the imperial cycles span several empires or dynasties and I have generally selected one of these to name the entire imperial cycle. They are intended only to provide a label and a rough point of reference.

The database (see Appendix) consists of 13 worksheets. The first seven represent analysis of the data and the figures generated for use in this paper. Each analysis sheet holds a somewhat different summary representation of the social cycles used to describe the event data. The final six hold the underlying event data and the mapping of cycles onto these events. The data worksheets are generally arranged by geography to simplify comparisons of neighboring empires. The first of these, labeled *Ancient*, contains a variety of ancient cultures from the Middle East and Mediterranean areas. The others are purely geographical. There is some repetition of empires across these sheets to, once again, facilitate comparisons of interacting empires. (For example, Rome and Greece are found on both the *Ancient* and *S Europe* worksheets.) In these cases I have tried to maintain exactly the same events on both sheets.

Each data sheet consists of a timeline in the first column, followed by a group of three columns for each imperial cycle. Within these three columns, the first indicates the stage of the social cycle (F = Formative, + = Sons generation, – = Fathers generation, and blank representing an integrative generation or one outside the imperial cycle). The second column holds the actual date of the event, and the third holds a brief description of the event. Place names generally refer to one of about 200 regions that I use to roughly localize actions without intending to be particularly precise. Occasionally there may be additional columns to provide additional room for notes or alternative mappings as necessary. The rows in the data sheets each represent one generation of time. An arrow alongside the diagram shows the flow of time.

Methodology

My mapping process started with a coarse grid from 3200BC to 2100AD[1] with granularity of one generation. Using this grid I organized historical events associated with various well-known 'empires' along this time scale. I used these significant events to characterize the generation as a positive or negative period for that empire. I found that coarse, popularized historical summaries such as those found in Wikipedia best suited my 'big picture' purposes, since sophisticated academic works provide a level of detail not necessary for this analysis. If examined in sufficient detail there are assassinations, civil uprisings, or other negative events, in most generations but these details should not necessarily characterize the general nature of the generation. Generally speaking I classified conquest of neighboring regions, 'golden ages,' and prosperity as indications of a positive generation and assassinations, uprisings, natural disasters, and loss of territory as indications of negative generations. Positive events are expected to occur primarily in formative phases, integrative phases, and the sons generations of the fathers and sons cycle. Negative events are only expected primarily in the fathers generation of the fathers and sons cycle. While I do not believe that natural disasters are likely to be governed by these cycles, I do believe that the impact of a disaster is worsened by a declining society. Historical accounts are more likely to focus on and record disasters as an explanation of the negative generations in which they occur. As you might expect, patterns of these positive and negative generations began to reveal the cycles in which they were embedded.

[1] As it turns out the exact starting year for this grid is not critical although there are a few examples where the strategic pattern is somewhat obscured if the wrong gridding is chosen. For example the mapping of the Ottoman Empire works out better if one of the grid generations begins in 1283 instead of 1275 which was used for most of the empires. Also, for mathematical simplicity I have ignored the issue of year zero. This does not seem to impact the results.

I will readily admit that this mapping process is subjective and is likely to be improved by later more detailed studies in which quantitative data can be used to defend claims for specific aspects of the mapping. However, the purpose of this database is to establish a baseline, strategic view to which others can provide refinements. I also believe there may be significant periods for which little data are available. If this database helps us find the strategic patterns that govern history, then we should be able to use these patterns to generate hypotheses for these periods, driving the search for data to test these theories.

During my analysis of the events in the database, four exceptional patterns were noted. First, I discovered that events described as civil wars often came in two varieties. One kind represented the struggles between rising internal forces attempting to consolidate power. The other described uprisings against an established (decaying) power. The first kind often occurred during formative phases, (sons) generations or integrative phases, and the other during the disruptive (fathers). A second pattern involved heroic figures that that 'restore' their empire to its glory. In these cases, shortly after the hero's death the empire's glory fades again. These heroes such as Marcus Aurelius, Saladin, and Justinian II generally emerged during one of the upswing generations of a fathers and sons cycle. A third pattern involved the exchange of territory between neighboring empires whose fathers and sons cycles are out of phase. One empire might experience a series of military victories while in its positive period, and then lose its gains to the other as it swings into a negative period. The Punic Wars are an interesting example of this process as the beginnings of both the First and Second wars favor Carthage. In both cases, however, the momentum shifts to Rome by the end of the wars. Interpreted as cycles, in both cases Carthage's imperial cycle is in a positive generation at the start of the war, but then shifts to a negative generation by the end.The fourth pattern consisted of occasional defeats recorded during what otherwise might be an integrative period. (For example, the Egyptians at the Battle of Kadesh are in an integrative phase against Hittites just entering their own third integrative phase. Someone had to lose.) Just because an empire is growing doesn't mean it is invincible. All four of these patterns reinforce the idea that some interpretation is required and that 'exceptions' might occur in the middle of the strategic patterns.

Keep in mind this mapping activity was a highly empirical process. A much more detailed analysis would be required to validate that the mechanisms described by Turchin and others are actually occurring. This is simply a mapping of the cyclic model onto the most visible events of history. One by-product of this empirical approach is that in a few cases traditional definitions of empires have had to be stretched. Sometimes nearby empires with different names continue the same imperial cycle (Akkadian/Sumerian, Hun/Turkic/Mongol), and sometimes empires sharing a common name are

best represented by different imperial cycles (The Old and Middle Kingdoms of Egypt). In the case of Egypt, the mapping that I produced separated ancient Egypt into two adjacent imperial cycles somewhere around 2200BC. Is it possible that some significant natural disaster might have caused this collapse, forcing a subsequent restart of the cycle? This mapping has also highlighted the plausibility of non-traditional, loosely defined 'empires' such as the Hun/Turkic/Mongol excursions from central Asia and 'Vikings' (Normans, Danes, Swedes, early Russians) overflowing from Scandinavia. While this model does not depend on these entities it is interesting to note the rough similarities within these groups in terms of time of emergence and geographical proximity. I have also chosen to omit from my study several plausible empires including Genoa, Venice, the Aztecs, the Incas, and several modern states. In each of these cases I felt that the lack of known historical events, the duration of the empire, and/or the nature of the empire was sufficiently different to make their inclusion problematic. In most of the empires included in this study large scale territorial gains were one of the indicators of growth and prosperity. By their very nature Genoa and Venice lacked this key indicator. Once again, a more thorough study might be able to incorporate these groups.

Observations

Overall this process resulted in identification of 155 secular cycles spread across 46 imperial cycles, illustrated in Figure 1. There is an apparent change in rate of empire formation starting around 400AD. Unfortunately, we cannot tell whether this is an actual rate change, an effect caused by loss of ancient records of early empires, or simply caused by my choices regarding whether to treat adjoining empires together or separately. For example, merging the Scandinavian empires would slow the rate after 400AD.

This increasing rate of territorial aggregation has been noted in other studies as well. Specifically, this data is consistent with the exponential growth of polities mentioned by Taagepera and illustrated in Fig 4 of the paper *Expansion and Contraction Patterns of Large Polities: Context for Russia?* (Taagepera 1997). In his paper he uses a calculated effective number of polities based on territory and population. In a similar fashion the current study measures the number of empires directly. In both cases these metrics grow exponentially over time, as can be seen in Figure 2.[2]

[2] Note that the exponential fit is particularly good for the years BC, but there may be some interesting oscillations in the years AD. The recent drop-off might be the result of colonial expansion, or simply my bias in what I think of as an 'empire'. For example Canada is not included even though it certainly is big enough.

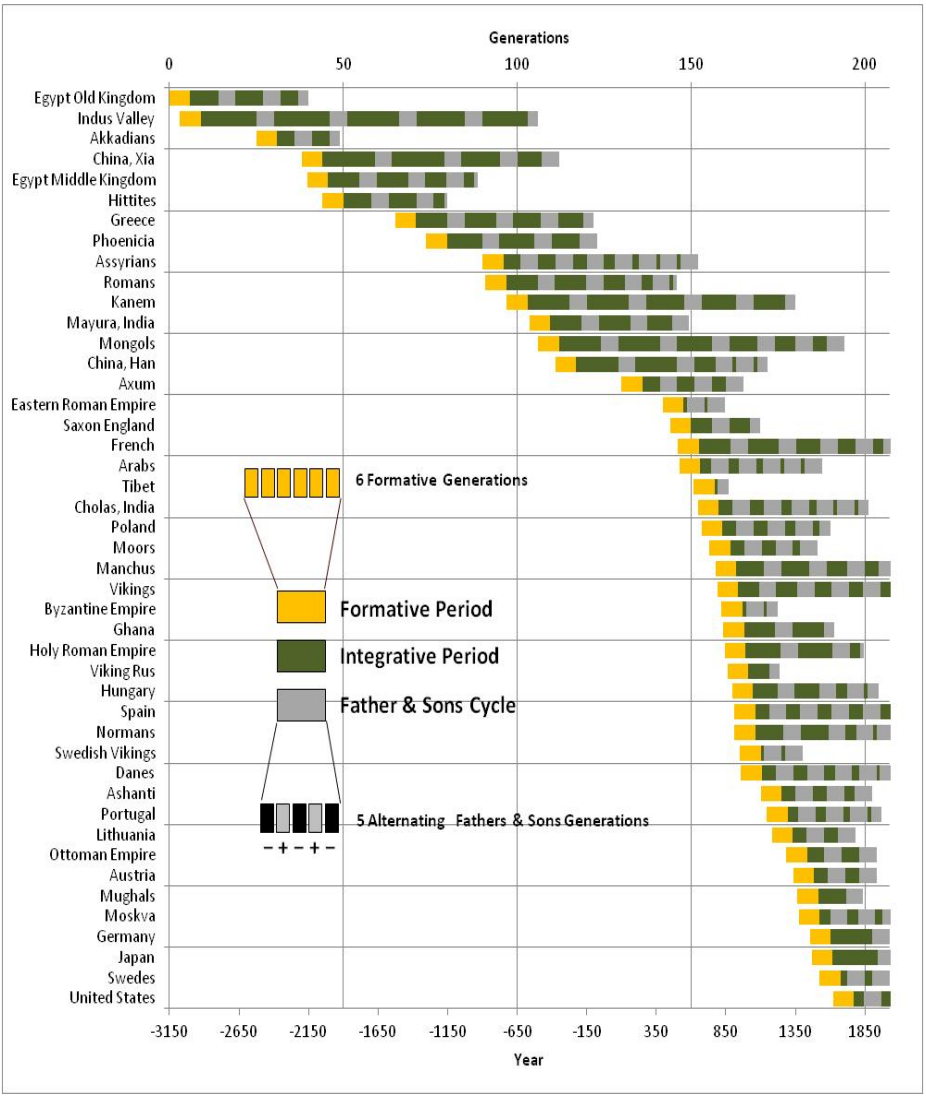

Figure 1. Mapping of all imperial cycles and their components.

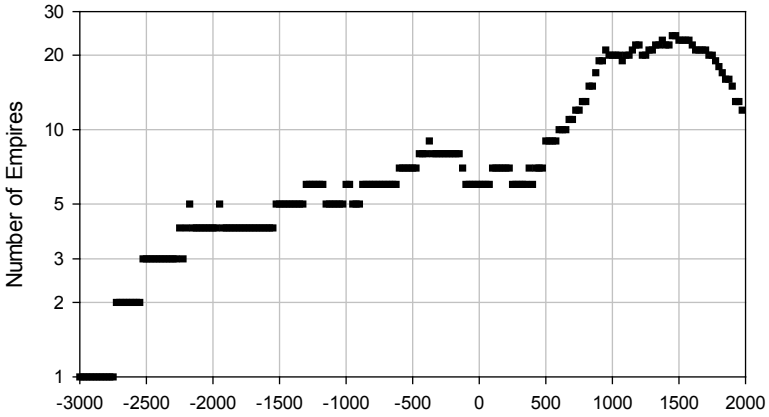

Figure 2. The number of empires grows over time (note the logarithmic scale).

When calculating the duration of the secular cycles in this data set the average period is 314 years—in close agreement with Turchin and other writers who have observed that the total period of a secular cycle "appears to be roughly 300 years..., but depends greatly on specific conditions" (Baker 2011). Originally, I expected that the integrative periods would be roughly constant, or unpredictable. In fact, I first attempted to create such a mapping with fairly constant integrative periods, but observations of the patterns over extremely long periods suggested that generally declining periods fit the data better. To view the pattern I have broken each of the 44 imperial cycles from Figure 1 at the end of each fathers and sons cycle, and aligned these 151 social cycles at these ends. This facilitates viewing the pattern that emerges in the lengths of the integrative periods. While I acknowledge that the fit of this extremely uniform pattern to the data is somewhat forced in some cases,[3] overall the pattern holds up quite well. The resulting stair step patterns can easily be seen when these 151 social cycles are graphed as shown in Figure 3. These stair steps show that within an imperial cycle the lengths of the social cycles decrease regularly from one to the next.

[3] 78 percent of the 557 dated events fit in an appropriate (positive or negative) generation without adjustment. Of the remaining 22% the average adjustment is 5.8 years. If we characterize this adjustment as model error the data points have an average error of 1.2 years with a standard deviation of 3.0 years. These 'errors' are consistent with uncertainty in the actual length of a generation (25–30 years) vs. the artificially fixed 25 year generation defined by the model.

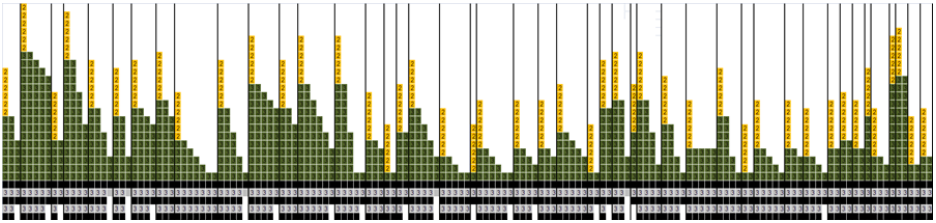

Figure 3. Strategic perspective shows the regularity of the pattern across imperial cycles.

Unfortunately the amount of information in Figure 3 make the details unreadable, so I have included additional figures (in Appendix) which contain the same data in a somewhat easier to read format. In Figures A1, A2, and A3, each block represents one generation, each row represents a secular cycle, and each section of rows represents an imperial cycle. The formative generations are the yellow blocks at the beginning of each imperial cycle, the integrative generations are shown in green, and the black blocks near the end of each secular cycle represent the declining generations of the fathers and sons cycles. The intervening light gray blocks represent the sons generations of the fathers and sons cycles. The dates shown represent the first generation of the imperial cycle.

In the resulting data set it was observed that each imperial cycle (rise and decline of asabiya) begins with a constant 6-generation (150 year) formative period, typically covering the time from recognition of the (to be imperial) entity to the beginning of significant imperial growth. As a simple example of this formative period, the British began settling their American colonies roughly 150 years before the colonies declared independence. This formative period is immediately followed by an integrative period, which is in turn followed by a 5-generation (125 year) fathers and sons oscillation of decay, peace, decay, peace, and decay. Most imperial cycles end on a degenerative generation (usually the third) of a fathers and sons cycle.

While qualitatively this is the Turchin secular cycle, the important differences arise when looking at repetitions of the secular cycle within an imperial cycle, or across different imperial cycles. The durations of each integrative period within an imperial cycle form an arithmetic sequence. i.e. In this pattern each imperial cycle is characterized by two parameters T and D. The length of the first two integrative periods are the same (T), but after that each integrative period is smaller by a constant (D). So the prototypical imperial cycle consists of a sequence of periods following the pattern: 6, T, 5, T, 5, T−D, 5, T−2D, 5, T−3D, 5, ... This sequence goes on until the empire fades

into obscurity or is conquered by another empire. (In the figures D represents the change in the length of the green bars from one social cycle to the next.) Originally I expected that the integrative periods would be roughly constant, or unpredictable, but it appears that this declining sequence is a better match to the observations.

This declining trend is clearly shown in Figure 4 which measures the average total duration of each integrative period which is active during a given generation. This average value is plotted by generation to show a strong overall trend. (Note the interesting deviation around 400 AD—the same period observed above where there is a clear change in the rate of empire initiation.) A similar trend can also be seen in Figure 5 which only plots the duration of the initial integrative period in the year when that period starts. Apparently the length of the initial period also shrinks over time, although the correlation is less pronounced. These trends do not necessarily support abrupt, qualitative changes in historical cycles (e.g. Global Economy Processes) as have been proposed by some authors in attempts to describe more modern periods (Thompson 2010). Instead, this model suggests that roughly the same cyclical behavior is occurring today that was observed in ancient empires, but on a faster timescale.

If one is inclined to argue over the specifics of the mapping (names of the periods, specific events, the start and end dates of periods, etc.) there are numerous opportunities to debate. I wouldn't even try to defend most of them.

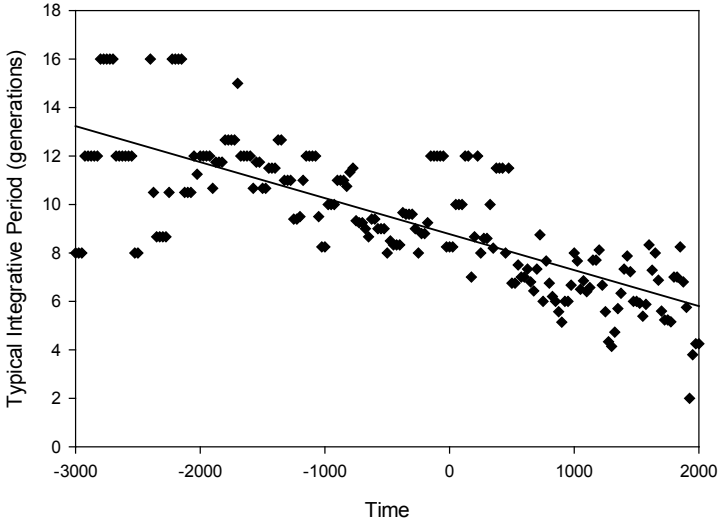

Figure 4. The average length of active Integrative Periods shrinks over time

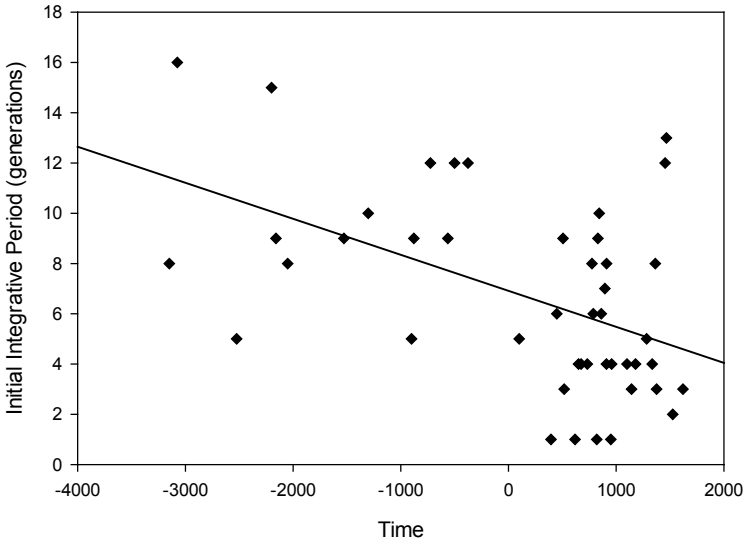

Figure 5. The length of the initial integrative periods starting in each year.

My point is focused on seeing the big picture which individual details tend to obscure. Only when seen in aggregate do these events paint a picture. I would also argue that the lack of precise dating, changing calendar systems, biases in modern beliefs based on the way history has been passed down and interpreted, and missing or conflicting records all lead to potential error if one depends on exact dates. Furthermore this work is predicated on the Secular Cycle model which is heavily dependent on the concept of 'generation' which does not precisely translate into dates. My use of 25-year periods is a simplification which allows me to conduct an otherwise intractable study.

Prediction

Any useful theory should provide new insights or be testable—i.e. make predictions outside the original data set. In this case as more researchers explore detailed mappings of individual empires the general body of research should record a shortening of these cycles later in history. My rough calculations estimate that the duration of the initial two integrative periods decreases by about one generation every 769 years. Unfortunately there is a lot of scatter in these values so it may be difficult to detect this trend.

A second test of this theory will occur as relatively unknown periods in history are researched. My mapping has already laid out the big trends, even for periods in which I had no data. The cycles were identified from periods

where data exists, and then carried across periods where data was missing. If the theory works new historical discoveries will generally fit to the predicted cycles. In my data set there are at least three imperial cycles (Kanem, Yoruba, and the early Indus region) waiting for confirmation by future research, or experts with awareness of the historical details.

Perhaps the most interesting test so far occurred in the data for ancient China. Apparently in this dim period of earliest Chinese history there are three competing chronologies. After mapping later, better accepted parts of Chinese history I was intrigued to observe that extending this mapped cycle backward in time created a good fit to one of these chronologies (the Bamboo Annals), but not to the other two. This suggests that the ultimate success of this mapping could be supported or challenged by the eventual resolution of this conflict.

Open Questions

Even assuming that this variation on the Secular Cycle model is accepted there remain some open questions that should be answered.

What happens as the integrative period duration continues to decrease?

In very long imperial cycles or ones with a large decay constant, eventually the predicted duration of the integrative period would become a negative value. (Unless the empire is overrun by a neighboring empire, which is what usually happens.) What actually happens since the duration can't be less than zero? From the few samples of this in the current data set it appears that the pattern may simply degenerate into an ongoing fathers and sons cycle. Unfortunately, there are not enough of these examples to be sure.

What triggers the onset of a new imperial cycle?

As stated in *War and Peace and War*, these cycles typically begin on the frontal boundary from an earlier empire. In order to accommodate the first of these imperial cycles I might suggest that the more general concept is that severe social stress of many forms could act as the triggering mechanism. For example the earliest empires in Egypt and Mesopotamia might have been triggered by large population densities along fertile river valleys, perturbed by relatively small, temporary encroachment by the hostile surrounding environments. The populations being near their carrying capacity might have been forced to cooperate to increase their efficiency and survive a random period of shortage.

What happens to groups that break off to form a new empire (Mongols/Tartars)? Do they retain parent cycle?

In some cases the fragments seem to retain imperial cycle parameters similar to those of the parent, but in others the parameters seem unrelated. There are

also cases where two or more imperial cycles merge. (e.g. Poland/Lithuania, and Norway/Sweden/Denmark) What parameters govern the resulting merged cycle? How is this determined?

While these and other questions remain to be answered, and even the most basic characteristics of this variant on the Secular Cycle model demand a more detailed analysis, I hope that this brief study suggests a productive direction for new research. In order to facilitate this I have included the database which contains the events and dates used to create this mapping. Whether subsequent research refines and reinforces this idea of decaying integrative periods, or corrects the data and/or model in such a way to support a more constant integrative period, I am hopeful that this activity will help to clarify the nature of cyclic patterns of human history.

Appendix I (Supplementary Figures) and II (Excel Database): to access these files, go to the article view and click on the 'Supporting Material' tab in the left-hand column.

References

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