ESSAY

Arise 'cliodynamics'

If we are to learn how to develop a healthy society, we must transform history into an analytical, predictive science, argues **Peter Turchin**. He has identified intriguing patterns across vastly different times and places.

What caused the collapse of the Roman Empire? More than 200 explanations have been proposed[1], but there is no consensus about which explanations are plausible and which should be rejected. This situation is as risible as if, in physics, phlogiston theory and thermodynamics coexisted on equal terms.

This state of affairs is holding us back. We invest in medical science to preserve the health of our bodies, and in environmental science to maintain the health of ecosystems. Yet our understanding of what makes societies healthy is in the pre-scientific stage.

Sociology that focuses on the past few years or decades is important. In addition, we need a historical social science, because processes that operate over long timescales can affect the health of societies. It is time for history to become an analytical, and even a predictive, science.

Splitters and lumpers

Every scientific discipline has its share of splitters, who emphasize the differences between things, and lumpers, who stress similarities in search of organizing principles. Lumpers dominate physics. In biology, splitters, who care most for the private life of warblers or the intricate details of a chosen signalling molecule, are roughly matched in numbers by lumpers, who try to find fundamental laws. Social sciences such as economics and sociology are rich in lumpers. Sadly, few are interested in applying analytical approaches to the past. History has an alarmingly small proportion of lumpers.

Rather than trying to reform the historical profession, perhaps we need an entirely new discipline: theoretical historical social science. We could call this 'cliodynamics', from Clio, the muse of history, and dynamics, the study of temporally varying processes and the search for causal mechanisms[2,3].

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Let history continue to focus on the particular. Cliodynamics, meanwhile, will develop unifying theories and test them with data generated by history, archaeology and specialized disciplines such as numismatics (the study of ancient coins).

Is this proposal feasible? The most compelling argument against the possibility of scientific history goes like this. Human societies are extremely complex. They consist of many different kinds of individuals and groups that interact in complex ways. People have free will and are therefore unpredictable. Moreover, the mechanisms that underlie social dynamics vary with historical period and geographical region. Medieval France clearly differed in significant ways from Roman Gaul, and both were very different to ancient China. It is all too messy, argue the naysayers, for there to be a unifying theory.

If this argument were correct, there would be no empirical regularities. Any relationships between important variables would be contingent on time, space and culture.

Empirical empires

In fact, several patterns cut across periods and regions[3]. For example, agrarian, preindustrial states have seen recurrent waves of political instability — not interstate warfare, but lethal collective violence occurring within states, ranging from small-scale urban riots, in which just a few people are killed, to a full-blown civil war. This is just the sort of violence we need to understand: many more people are killed today in terrorist campaigns, civil wars and genocides than in wars between nations[4].

Recent comparative research shows that agrarian societies experience periods of instability about a century long every two or three centuries. These waves of instability follow periods of sustained population growth. For example, in Western Europe, rapid population growth during the thirteenth century was followed by the 'late-medieval crisis', comprising the Hundred Years War in France, the Hussite Wars in the German Empire, and the Wars of the Roses in England. Population increase in the sixteenth century was followed by the 'crisis of the seventeenth century' — the wars of religion and the Fronde in

France, the Thirty Years War in Germany, and the English Civil War and Glorious Revolution. Similarly, population growth during the eighteenth century was followed by the 'age of revolutions', ranging from the French Revolution of 1789 to the pan-European revolutions of 1848–49 (ref. 5).

Such oscillations between population growth and instability have been termed 'secular cycles'[6]. Given the limitations of historical data, we need an appropriately coarse-grained method to determine the statistical significance, and the generality, of the pattern. The basic idea is to demarcate population growth and decline phases, and to count the instability incidents (such as peasant uprisings and civil wars) that occur during each phase.

With my colleagues Sergey Nefedov and Andrey Korotayev, I have collected quantitative data on demographic, social and political variables for several historical societies. Applying the above approach to eight secular cycles in medieval and early modern England, France, the Roman Empire and Russia, we find that the number of instability events per decade is always several times higher when the population was declining than when it was increasing[6]. The probability of this happening by chance is vanishingly small. The same pattern holds for the eight dynasties that unified China, from the Western Han to the Qing[7], and for Egypt from the Hellenistic to the Ottoman periods[8].

Making waves

Such strong regularity points to the presence of some fundamental principles. Population growth beyond the means of subsistence leads to declining levels of consumption and popular discontent, but this is not enough to destabilize agrarian societies. Peasant uprisings have little chance of success when the governing élites are unified and the state is strong[9].

The connection between population dynamics and instability is indirect, mediated by the long-term effects of population growth on social structures. One effect is the increasing number of aspirants for élite positions, resulting in rivalry and factionalism. Another consequence is persistent inflation, which causes a decline in real revenues and a developing fiscal crisis of the state. As these trends intensify, they result in state bankruptcy and a loss of military control; conflict among élite factions; and a combination of élite-mobilized and popular uprisings, leading to the breakdown of central authority[3,9].

This explanation — the 'demographic–structural' theory — is a work-in-progress. Our tests with the eight case studies[6] support some of its predictions: for example, élite overproduction preceded the crisis in every case. The tests also identify areas where the theory needs to be modified. Perhaps we need an entirely new theory to explain the observed patterns and predict new ones, but that is the business of science. The important thing is that societies as different as medieval France, the Roman Empire and China under the Han dynasty share dynamics, when viewed in an appropriately coarse-grained way. Not everything in history is contingent and particular.

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Even so, theories developed and tested on preindustrial data must be modified before they can be applied to contemporary social dynamics. Happily, there are indications that our theories will not need to be replaced wholesale. Rapid demographic change and élite overproduction were still important factors in twentieth-century revolutions[10].

Furthermore, over the past 200 years, political instability in the United States has waxed and waned in a pattern reminiscent of that in preindustrial societies. Political violence — urban riots, lynchings, violent labour disputes and so on — was almost absent in the early nineteenth century, increased from the 1830s and reached a peak in around 1900. The American Civil War occurred during this period of growing unrest. The instability then subsided during the 1930s, and the following two decades were remarkably calm. Finally, in the 1960s, political violence increased again[11].

It remains to be seen whether a modified version of the demographic–structural theory can explain this pattern. The point is that the study of such slow-moving processes requires a long-term view and an explicitly historical approach.

Learning lessons

Any claim that history can become a predictive science raises eyebrows. But scientific prediction is a broader concept than merely forecasting the future. It can be used to test theories. For example, two rival theories may make different predictions about the behaviour of some variable, such as birth rate, under certain social conditions. We then ask historians to explore the archives, or archaeologists to dig up data, and determine which theory's predictions best fit the data. Such retrospective prediction, or 'retrodiction', is the life-blood of historical disciplines such as astrophysics and evolutionary biology.

Cliodynamic theories will not be able to predict the future, even after they have passed empirical tests. Accurate forecasts are often impossible because of phenomena such as mathematical chaos, free will and the self-defeating prophecy. But we should be able to use theories in other, perhaps more helpful, ways: to calculate the consequences of our social choices, to encourage the development of social systems in desired directions, and to avoid unintended consequences.

Like other systems with nonlinear feedback, societies often respond to interventions in surprising ways. When the Assembly of Notables refused to approve a new land tax in 1787, they did not intend to start the French Revolution, in which many of them lost their heads. When Tony Blair was Britain's prime minister, he set out to increase the proportion of youth getting higher education to 50%. He was presumably unaware that the overabundance of young people with advanced education preceded the political crises of the age of revolutions in Western Europe[12], in late Tokugawa Japan and in modern Iran and the Soviet Union[9,10].

It is time we heeded the old adage that those who do not learn from history are doomed to repeat it. We must collect quantitative data, construct general explanations and test them empirically on all the data, rather than on instances carefully selected to prove our pet narratives. To truly learn from history, we must transform it into a science. ■

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