Response to Lempert: Holism versus Systems Analysis

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I welcome David Lempert's interest in and criticism of the approach to studying the resilience of complex human societies that was outlined in our article (Turchin et al. 2018). We share a goal—understanding and predicting political violence, social resilience, and breakdown—but differ deeply on the methods best used in pursuing this goal. Lempert insists that only a holistic approach can help us understand social resilience and its obverse, social fragility that could lead to collapse. This sounds fine in a vague sense—of course we want to understand a phenomenon we study in its entirety. But in practice, holistic thinking leads us into a dead-end. This is why most of the 'success stories' in holistic social science that Lempert cites either stop with conceptual (read: non-quantitative and, in practice, often untestable) models or with static (read: lacking dynamics) structuralism.

The alternative approach that has proven its worth over and over again is the combination of analysis and synthesis, or Systems Science as it is often called today. In the first step, we break the studied system apart into subsystems and study how these parts interact with each other. Next, we put it back together, ideally as an explicit mathematical model (which can be formulated as a system of differential equations or as an agent-based simulation, to give just two examples). Ironically, it turns out, if one wants to study a system as a whole, one first needs to break it apart. Depending on the phenomenon that is studied, and the questions we want to ask, there are better and worse ways of performing these steps of analysis and synthesis. But the overall approach works. Why?

The core activity of science is the empirical testing of theories. As a scientific field matures and addresses theories of increasing complexity, it needs to become progressively more 'mathematized'. Mathematics provides a formalized language for precise description and rigor ensuring that conclusions indeed follow from premises. Mathematics is not just about quantities (it includes such fields as mathematical logic, abstract algebra, and topology). However, if we are interested in understanding the dynamics of such historical processes as population change, territorial expansion/contraction, societal resilience to internal and external shocks, and social breakdown, we must get involved with numbers and rates. A

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'naked' human mind, unaided by mathematical formalism and computers, is a poor tool for uncovering dynamical processes characterized by nonlinear feedbacks or for grasping such complex behaviors as mathematical chaos.

Without mathematics (understood broadly), we run the hazard of arriving at wrong conclusions or, at best, making vague, largely descriptive or speculative statements. This is what one often sees coming from holistic social scientists. As an example, consider the article "Predicting Political Systems Using Economic, Environmental and Relational Variables" (Lempert 2016). The article uses qualitative, conceptual models (e.g. Figure 1, 2, etc.), which do not yield quantitative predictions. Indeed, predictions (e.g. Tables 2 and 3) take the form of classification tables. For example, Table 3 predicts the form of political system based on two levels of ecosystem and technological inequality ("low", "high") and three levels of geographic and communications distance ("low", "medium", "high"). It is not clear why quantitative variables need to be classified into two or three discrete categories. Additionally, a variable such as "ecosystem and technological inequality" appears to conflate two very different concepts into a binary variable (with values of "low" and "high").

How can we test theoretical predictions or derived hypotheses with data, if we are not even sure that the 'prediction' in fact follows from the theory's premises? Furthermore, once we start confronting theoretical predictions with data, we encounter a host of other problems: missing data, uncertainty and disagreements, spurious causation, and many more. To overcome these problems, we need sophisticated statistical methods, which are based, again, on mathematical models.

In my response I focus on only one, although central, tenet of Lempert's challenge to our proposed methodology for studying social breakdown, and I let others respond to his other charges. But before ending this rebuttal, I want to point out that Lempert should study more thoroughly the discipline that he criticizes. For example, at one point he states that "The cliodynamic researchers do not seem to have any testable theoretical hypothesis." Nothing could be further from the truth. Table 1.1 at the end of Chapter 1 in *Secular Cycles* (Turchin and Nefedov 2009), to give just one example, lists more than ten hypotheses that are then systematically tested in the rest of the book. Moreover, our field is one of the few ones that encourages publishing hypotheses *before* data are collected to empirically test them. As an example, see Figure 1 in Turchin et al. (2015), which lists both hypotheses stemming from the Z-curve theory (a theory that we aim to test) and possible alternative hypotheses. Just because we are not interested in trumpeting any one 'pet' theory in detailing plans for our Multi-Path Forecasting project, does not mean we have none!

Lempert concludes his commentary remarking that my colleagues and I "may now be misled by what is happening in current social science disciplines, in their attempt to add in social science to their models." We are not 'adding in' social science to pre-figured 'models'. As we attempted to articulate in our MPF article, we are seeking to: (1) develop theoretically informed and mechanism-based models taking into account the many different possible factors that could affect societal resilience and their dynamic interactions; (2) use these models to generate quantitative predictions; and (3) gather empirical, historical evidence to test such predictions from alternative hypotheses. In fact, I can think of nothing more 'holistic' than such a Systems Scientific approach.

References

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