GLOBALIZATION IN THE LONG RUN: SPATIAL AND TEMPORAL BOUNDARIES OF WORLD-SYSTEMS

BOUNDING HUMAN INTERACTION NETWORKS: CONSIDERATIONS AND CONTRIBUTIONS

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A range of important global phenomena may be studied with reference to changes in the size of global interaction systems. Without creating a method by which to map systemic boundaries over the long historical term, we can have little to say about 'globalization' and its current challenges, the long-term increases in the sizes of cities, states, and systems, and their periodic retrogressions, the trajectories that are generated by trade network mergers, political engulfments, and increasing inequality. Undertaking these questions across the widest possible range of geographic systems will also allow us to escape the confines of Eurocentric analysis. In forthcoming work, Chase-Dunn, Inoue, and Neal propose a series of 'high-bar' criteria for establishing systemic boundaries. The articles that follow address this issue historically, conceptually, and critically.

Overview

The desire to engage in a time-mapping of systemic human interaction networks over the longest of historical terms is not simply of academic interest. The global social order is currently facing a variety of contradictory challenges. It is simultaneously consolidating and fragmenting; gaining strength and becoming more fragile; its populace is growing richer and poorer; and its states share increasingly similar interests but express greater antipathy toward one another. Just a few decades ago we were discovering 'globalization' (Hall 2017). Our current retreat from those phenomena appears frightening. Is there some real limit to that process, or has globalization, and a similar backlash, appeared before? We argue that such contradictions are not unique to our time. They emerged at other times and places. The reasons we are interested in bounding transnational systems include the desire to identify the full range of when and where similar phenomena might be noted. The more we understand about the context and pattern of such changes, the more we will understand very contemporary issues as well. To do so we might compare whole systems to address questions of similarities and differences. This might also help shed light on the causes of long-term increases in the sizes of cities, states, and systems, and the timing and extent of their periodic retrogressions. To escape the confines of Eurocentric analysis we must look for such systems in other places and at other times. Doing so will allow us to say a great deal more about the var-

ious trajectories that are generated by trade network mergers, political engulfments, and increasing inequality. These, along with similar challenges, animate our desire to better understand human interaction networks.

We begin with a quick recap of human social evolution to place the bounding problem in a larger context. About 10,000 years ago there were about 100,000 societies with a mean size of 100, for a total of about10 million people. Today we are knocking on the door of 10 billion people, an increase of 1,000 times over 10,000 years. Today we have about 200 hundred state-bounded societies. This gives a crude mean of about 50 million people per state, with several larger, over 1 billion, and several very small. Based on these facts, some fundamental issues in social sciences include: 1) how did this happen?; 2) could it have happened differently?; 3) at what point – if any – did the processes of growth become limited to only few choices?; and 4) what possible future(s) may emerge?

Steve Sanderson (1999a, 1999b) argues, along with others, that social evolution differs radically from biological evolution in that changes over time in social systems tend to converge, whereas biological systems tend to diverge (Jablonka and Lamb 2005). Hence, point three above. Sanderson (1999a) also notes that the processes and sequences of social evolution are crudely parallel between the Old World and the New World – more precisely Afroeurasia and the Americas. This suggests underlying uniformity or unity or similarity of processes.

A key process in social evolution is how to deal with problems of scale (Bodley 2003; Carneiro 1970, 2012). A major solution to larger scale organizations was the invention of the state, which first occurred about 5,000 years ago in Ur in the Middle East/Southwest Asia. States were also invented independently in at least five other places. This, too, implies some underlying regularity. This development is one instance where social evolution shows more convergence over time than divergence. So, question 2) might be rephrased: Could there have been other forms of states? We note that in the process of social evolution it is typical that first inventions are selected in a satisficing process – that is, the first solution that works is adopted. Later when multiple solutions are developed, they are winnowed by increasing competition, with gradual and sporadic movement toward the most efficient of those solutions. However, the first solution(s) may have precluded inventions of others, especially locally or regionally. Today states are more-or-less modeled on an ideal situation in which one nation (defined in terms of a population with a collective identity) seeks to become self-governing by fixing borders and building institutions to serve the existing nation. Not only is this rare, but in most cases states predate nations while the attempts to instill a unified identity are engineered by the states on a post-hoc basis. Even then, with contemporary migrations, those states that consisted of one nation are becoming rarer. Still, a global form of state entities seems to have emerged (Meyer *et al.* 1997), though it is not entirely clear that this was inevitable except that Europeans adopted this form and had more and bigger guns to coerce others toward this solution. These, to say the least, are complex and vigorously contested ideas. Still, one cannot begin to address questions 2 through 4 without having a more robust answer to the first question: how did it happen?

The picture becomes even more contentious with Wallerstein's argument (1974a, 1974b, 2011a, 2011b) that the unit that changed was not (solely) the state, or society in pre-state times, but what he called a world-system. We further caution that Wallerstein and many others insist on the hyphenated form of the term ‘world-system’ because it re-

fers to a delimited set of interacting areas. Because states, and even non-states, have always interacted extensively, if in limited areas, it is these zones of interaction that are an appropriate unit of analysis. Wallerstein explicitly stated that the 'world' in world-system did not mean 'planetary'. Rather, it meant more or less self-contained regions of interacting social groups. The 'more or less' qualification is why one reason of bounding systems is important. Further, Wallerstein originally discussed only the last five centuries or so. Others, notably Chase-Dunn and Hall (1991, 1997), Frank and Gills (1993), and Gills and Thompson (2006) have extended the use of world-systems analysis into the ancient world and some to prehistoric times. Other scholars have noted that such interaction systems have been common throughout human history (summarized in Denemark *et al.* 2000).

The further into the past we examine these interactions, the more nebulous their boundaries are. Indeed, as archaeologists are wont to note: absence of evidence is *not* evidence of absence. There is no definitive inventory of such interaction systems, although the broad outlines of the number of interactions systems or world-systems, is reasonably clear. But if we are to study the evolution of such systems as a way of answering how humans moved from very many small groups to a few very large groups, knowing what systems exist and what their boundaries have been, is a vital part of such comparative and evolutionary analysis.

This is why we would demur with some of our authors and argue that it is too soon to develop definitive explanations of change. We need to know more about what systems existed, what happened, and why, and what alternatives fell by the wayside. This is not to dismiss their (and others) suggestions out of hand. We do well to examine their suggestions and use them to help us think about bounding and defining systems. If, indeed, there are master processes or variables, they will probably cause us to rethink our bounding criteria. A major contribution of the boundary project as conceptualized by Chase-Dunn and colleagues (forthcoming) is that it uses explicit boundary criteria. Their criteria make it more feasible to re-examine which if any conclusions based on these criteria are indeed valid, or artefacts of those criteria. Furthermore, it will make it easier to see how conclusions might be altered if boundary criteria are changed.

Of the six essays in this collection, three were prepared to aid in the effort outlined by Christopher Chase-Dunn to help organize a time-mapping of the global system along lines originally presented by Chase-Dunn and Hall (1997) and Wilkinson (1995, 2000, 2003, forthcoming). In its most recent iteration, Chase-Dunn, Inoue, and Neal (forthcoming) seek to solidify the definition of a systemic boundary. They use a set of four nested systems beginning with local exchanges of everyday (bulk goods) products, then expanding into space to political/military networks, prestige or luxury goods networks, and finally the extent of information flows. It is important to establish the consequent reach of these systems. Though random goods, soldiers, or information, may be found in an area, constraints on the existence of any real network like the rarity of interaction, its oddity, or its lack of continuity, suggest that we may be beyond the effective limit of impact. Declining impact over distance is usually referred to as 'fall-off'. After a certain point, artifacts might exist but their impact is increasingly negligible.

In order to study the effective limit of these systems, Chase-Dunn and his colleagues propose that we begin with a rigorous standard. For bulk goods, a system consists of five autonomous adjacent polities and all other polities that obtain at least five percent of total bulk good consumption from any of the constituent members. Bulk

goods networks are transport-dependent and will alter in size as long-range transportation technologies develop.

The boundaries proposed for political/military systems also begin with sets of five adjacent polities and extend to all who engage in both direct conflicts or make meaningful alliances with any member of the group. In political/military systems the network also extends to those engaging conflicts or alliances with any polities involved. Put differently, networks extend to those with one degree of separation from the original group of five.

Prestige goods networks, *sometimes labeled luxury goods networks*, and information networks, are bounded in similar ways. For prestige goods, the relevant network is defined as the extent of those areas where five percent or more of annual prestige goods imports come directly from any of a group of five contiguous polities. Information networks exist when two-way communications can be identified as playing an important role in the reproduction or transformation of social structures within a group of five contiguous polities. The network extends from any of those five to any other polities that evidence the same significant impact from information transmitted.

These 'high bar' rules were offered as a starting-point for an analysis of human interaction networks. Chase-Dunn and his colleagues hoped that this set of very general criteria would help us focus our work and provide both substantive insights and definitional feedback. We have the ability to engage in time-mapping of the systems that do not fully meet the high bar requirements. We can use approximate conformance to the requirement, with notes that these are approximations subject to revision with improved evidence (which also holds for all the cases).

The Essays

The first three articles establish that producing a comprehensive map of the spatial and temporal boundaries of transnational systems since the Bronze Age is not a fool's errand. It would be futile to seek such information, whatever its utility, if it were simply unavailable. We contend, to the contrary, that it is available. The value of getting out of our disciplinary silos, or at least interacting with those in very different fields, offers a quick antidote to the misconception that hard social indicators are only of recent origin. Archaeologists possess a variety of powerful tools with which to establish an array of interesting variables. We are grateful to Berdan and Smith for illustrating our ability to define and establish systemic boundaries in a context that might be considered particularly difficult: Mesoamerica.

Frances Berdan considers the Aztec Empire of the mid-fourteenth to the early sixteenth century CE. During that period the Empire grew, partly by alliance formation and partly by the violent subjugation of surrounding peoples. The expansion was not a smooth process. Fragile political groups and well established commercial networks overlapped and interacted. New administrative boundaries were imposed upon existing city-states. Merchants played a dual commercial/political role, and expanded their reach given incentives provided by both economic and political forces. With political expansion came further economic integration, with all the uncertainty inherent in the co-evolution of those processes. Boundaries were constantly in flux, but the work illustrates ways to marshal evidence that can shed light on exactly those issues that help us define social systems.

Michael E. Smith also considers the Aztec polity. He asks whether it was an empire, and if so, what were its boundaries. For Smith, the work of students of politics and

sociology is adopted in search of an adequate set of the defining elements of empire. Smith then searches for them on the ground. Once they are discovered, the question becomes one of their extent. Here Smith updates work by Cherry (1987) that identifies appropriate epigraphic evidence and varieties of linear and spatial methods that can help bound a complex system that disappeared long ago. Smith is careful to outline a set of possible complications. City-states and non-territorial polities may not fit well into the nested (and essentially territorial) structure that Chase-Dunn and his colleagues propose. Modes of social control (direct *vs* indirect rule; different strategies for dealing with provincial areas; and levels of autocratic *vs* collective decision-making) differ in ways that are difficult to interpret once we leave the relatively safe haven of territorial claims. Smith offers both constructive criticisms and a series of choices to those engaged in this project.

We might also consider the criticism that the range of parameters that may constitute a transnational social network is too broad or contextually tailored to be recognized or understood in distant hindsight. The Aztecs had an 'empire'. Other systems are not so easily defined. In some ways archaeologists may be in a better position to define ancient boundaries than other social scientists, since they base their conclusions on the distribution of material goods and have created and long-utilized techniques that go at least part way to distinguishing goods moved by trade from those made locally. This, of course, makes their cautions and insights more valuable.

In the third article, Denemark examines the role of maritime interaction in the creation of socio-political and economic systems. While Chase-Dunn *et al.* focus on terrestrial contiguity in their conceptualization of systemic boundaries, interactions across rivers and seas go far beyond simple trade. In this work, pirates are shown to generate both state consolidating and globalizing processes in a direct and positive (not a reactive) manner. The various ways that pirates help form political/military, prestige goods, and information networks are illustrated in contexts ranging from the Classical Mediterranean through medieval and early modern Europe, and then into the Americas, the Indian Ocean, and further east into Asia. In making the important choices necessary to study the bounding of global systems, Chase-Dunn *et al.* may have introduced a terrestrial bias into their analysis. Denemark suggests that through a reconsideration of the manner in which maritime borders are treated, or via comparisons with outcomes from alternative methods of identifying systemic boundaries, the project can avoid unintended bias.

The consideration of piracy brings to mind two other discussions. First is Hall's discussions of frontiers (2009, 2013, forthcoming). One of his key arguments is that boundaries, especially those that are frontiers (using the North American concept, not the common meaning in European languages where frontier is a synonym for border) are necessarily fuzzy and fluid. Hence frontiers are zones, not lines. They are shaped and reshaped by complex interaction between local, regional, and extraregional actors and actions. He further notes that too often the focus is on how cores shape frontiers, and less often on how frontiers (re)shape cores. As in the discussion of pirates, territoriality is considerably more complex than suggested in the contemporary literature.

The second issue is a bit more epistemological. In a masterful discussion of the ways in which Africa contributed to world history and the development of the Afroeurasian world-system, Patrick Manning presents a useful discussion of potential boundaries of Africa (Manning 2017). He presents three variations: continental Africa,

sub-Saharan Africa, and Africa plus Arabia. The answer to how to bound Africa is not entirely an 'African' issue, but rather must include the contexts and reasons why Africa is under consideration. The take away here, as in several of these papers is what questions one is asking and studying. These play a major role in deciding which boundary is the appropriate one for the issues at hand.

The second set of three articles suggests that scholars may well and legitimately disagree with one another about how to engage in attempts to time-map globalization. Each offers a very different set of starting propositions, a novel architecture for addressing the issues, along with new and interesting insights into such a process. Each may also be queried as to possible oversights.

The first critical systemic article, by Albert Bergesen, questions the logic of engaging in any attempt to map systemic boundaries because the world-system perspective has basically been about classification, and classification is a dead end without a sense of the generative elements of any given system. His review of fields of study that have made the leap from categorization and classification to the identification of the truly dynamic mechanisms of system mechanics is insightful and should be considered seriously. Instead of a time-mapping exercise, he argues for the identification of specific units with specific modes of production, and the ways they combine (and recombine) to form large-scale social geo-political networks. Bergesen takes these units as primordial. They appear to exist in a specific form and may become linked to other units with other forms in patterns that may emerge as more or less viable and powerful. This critique and reformulation has much to offer, but in terms of mapping human interaction networks it suggests more that we search for a different generative architecture than that we abandon the time-mapping project all together. We cannot identify combinations of primordial units without a set of criteria for defining that combination, nor can we illuminate the outcome of various combinations without noting the change in those interactions over time. Though Bergesen is suspicious of the end results of the time-mapping project, it is difficult to see how his perspective can avoid elements of that same exercise.

The second critical systemic article, by Andrey Korotayev and Julia Zinkina, suggests that we focus on the dynamics of the effective spread of technology. They point to the striking insight that human population growth over a 2000-year period may be expressed with a relatively simple equation. We understand that the carrying capacity of the planet is based on the development of technology in the domestication of food crops, metals for tools, transportation, and weapons. If this is the case, then it is reasonable to suggest that technology must be developing at a consistent rate as well. From such a perspective, world-systems would be effectively bounded by the extent of technological diffusion at any given period. Core areas would be re-defined as those within which we find the greatest levels of technological innovation. Such zones are not considered in any explicit manner in the bounding project of Chase-Dunn and his colleagues. Although the assumption that the development of technology can be understood as being so remarkably regular is controversial, the pattern of data on population growth over the long term presents a significant puzzle to anyone who would wish to undertake the effort of time-mapping globalization.

The third critical systemic article, by Leonid Grinin, focuses on the argument that changes in technology that generate changes in productive systems which further generate new social and political formulations. He offers a model of historical globalization in which technology cumulates and generates qualitatively new levels of social com-

plexity. From this perspective, globalization is not just about physical scale but also intensity and complexity. Building on a large body of work, Grinin offers an alternative conceptualization of the growth process of civilizational integration that reveals a scale transition that moves from 'local' to 'planetary' processes. Every phase of this historical globalization is correlated with a new productive form and generates new social and political outcomes. Among these are state formation, urbanization, and integration based on divergence (derived from local technological improvement), to convergence (derived from technological diffusion and 'catching-up'). Unlike Chase-Dunn and his colleagues, Grinin's model calls for simultaneous considerations of confluences of technology, time, and space, to make sense of broad global processes. To help us understand this rather linear model, he does not focus on periodic retrogressions, or specific forms or extents of integration within the various epochs he identifies. Historical globalization is viewed instead at a relatively high level of abstraction.

Some Conclusions and Speculations

Together, these six articles suggest four tentative conclusions and point to further questions. First, it is important to pursue the time-mapping of systemic human interaction networks since the Bronze Age. As we have noted, we need to understand the dynamics of the growth of these systems to tease out patterns of change. This can only be done in a piecemeal way without such data. The time-mapping effort is central to the development of an understanding of the trajectory and various detours of the global social system. Second, it is by no means impossible to engage in such an exercise. What this requires, more than anything else, is a transdisciplinary effort that would allow us to escape our pre-conceptions, facilitate interaction, and engage in cumulative studies. Such an effort has begun under various guises. Third, though Chase-Dunn and his colleagues have a specific sense of how they might use what they will find, there are other ways of cumulating and interpreting the data. Bergesen suggests an alternative approach to understanding human social networks that is based on advances in other fields. His efforts will nonetheless still require systemic bounding.

Finally, although the project that Chase-Dunn and his colleagues have outlined is already quite large, we should be open to the suggestion that other elements of the process might be critical to incorporate. Korotayev, Zinkina, and Grinin all point to the central role of technology and its diffusion in the process of historical globalization. Technology might well be included as a key element in the broadest of Chase-Dunn's systems, the infosphere. If we examine the iteration model in *Rise and Demise* (Chase-Dunn and Hall 1997) and its many successors (most recently in Chase-Dunn and Lerro 2013), it is abundantly clear that technology is as often a dependent as an independent variable, or more precisely an intervening variable in a web of causality. Bergesen has noted that there has been great progress in ecological studies that examine interacting systems, and render concepts like dependent and independent variables moot or even useless. At best dependent and independent are only useful when studying a small segment of much larger network of intercausality. Here, too, the web of causality needs to be sketched more directly and rigorously so that systemic bounding can proceed with reference to all the constituent variables.

These conclusions, or more accurately working hypotheses, suggest a number of questions about modelling, about roles of technology, about connectedness, and about frontiers.

One suggestion about modelling, especially where data is fuzzy, if not downright misty, is to analyze the data both extremes: the widest reasonable systemic boundaries and the narrowest. We can be reasonably certain that an accurate model will be somewhere in between. Also, comparing the extremes can point to instances where the differences are critical to developing explanatory models, and where they might raise only minor issues. In the serendipitous event that the extremes are nearly identical, we can hold as an untested hypothesis that differences in locating boundaries is not a serious issue, at least for the topic at hand.

As noted, technology is often an intervening variable. Here, too, a caution. New technologies are often resisted, or even shunned, when powerful groups have a strong stake in the current technology – witness the resistance of fossil fuel producers with respect to alternative energy sources. There can be another difficulty with technology as a boundary marker. Some technologies diffuse easily. It only takes one defeat by a cavalry with stirrups for everyone to see both the utility of stirrups and how to produce them. Alternatively, the explosion of the first atomic bomb settled all debates about whether making such bomb was possible. But observation of an atomic explosion reveals little about how to make one. An intermediate example might be the relatively slow spread of corn (maize) production in what is now central Mexico to most of North America before the arrival of Europeans. In addition to the usual obstacles to adoption of new technologies, growing corn requires both mastery of specific environmental factors, and selective choosing of new forms of maize suitable for conditions other than those found in central Mexico. Again, this does not mean we should ignore data on technology, only that we use it cautiously and judiciously.

Crosscutting these issues is how much contact is sufficient to make a system, or to transform it in some way. Based on biological models of spread, Turchin and Hall (2003) show that even very low level contacts can have enormous effects when processes at considerable distance are cyclical. Low level contact can bring those processes into synchrony, thus altering local patterns. That this is well documented in biological research suggests the same may at times apply to human systems. This is why consideration of prestige or luxury goods is critical to delimiting boundaries. Furthermore, even when the cyclical processes are chaotic – that is, unstable and last for only a few cycles – the effect can be strong, and difficult to discern especially when the cycles are centuries long. It would be a reasonable strategy to stay with the high bar rules in the absence of compelling evidence that a lower bar might uncover important effects. An important effect is one that induces large changes in a system.

Finally, there is much to be learned from the study of frontiers. Here we draw on our own papers on boundaries (Denemark forthcoming; Hall forthcoming) and on the references to studies of frontiers cited in them. The first lesson is that boundaries are seldom sharp. The U.S. – Mexican border may be a sharp line on a map (and maybe a wall!) but many have documented how culture on both sides of the border tends to become more similar over time. This sort of converge has been common even where walls were built. In ancient times boundaries are often quite fuzzy. A waggish example: 'Where is the border? Go west to the sleeping dog under the mesquite tree, then go south for two hours.' Even where boundaries are somewhat delimited, the convergence we noted is often found. And some those boundaries that appear geographically clear (*i.e.* coasts) may not bound as much as facilitate further interaction.

The second lesson is that frontiers are most often zones that fade to no level of difference. Here, too, a high-low strategy can be used. Set the boundary at the nearest side

of the frontier zone, and another at the furthest side. Then compare the consequences for various analyses. Closely related to, and indeed a part of the fuzziness of frontiers is that they change, often much more rapidly than other parts of a system. Only slight changes in rainfall, temperature, or both can radically shift the boundary between steppe and sown, or regions where corn may be grown, and so on.

A third lesson is that with the traffic across or through frontiers and convergence in cultures, many new ideas, technologies, art forms, and so on, move to core areas from the frontiers. Typically, core areas with their hubris of superiority do not recognize this. Yang (2008, 2010; see also Barfield 1989) documents both of these for southwest China over many centuries. Such processes occur on most frontiers.

A fourth set of lessons are available from a variety of archaeologists and some historians. They have considerable experience mapping areas of similarity and frontiers between them (see Bartlett and McKay 1989; Batten 2003; Crossley *et al.* 2006; Green and Perlman 1985; Guy and Sheridan 1998a, 1998b; Hall 2009, 2013; Lattimore 1951, 1962; Lightfoot and Martinez 1995; Mostern 2008; Parker and Rodseth 2005; Power and Standen 1999; Slatta 1997; Smith and Rubinson 2003). They have developed techniques to discriminate between diffusion and independent invention. These can be very useful as techniques and as stimuli to considerations of boundaries.

The articles in this collection, along with those generated as part of the same recent effort (Chase-Dunn, Inoue, and Neal, forthcoming), and others undertaking this and similar efforts, pose a significant challenge. We must break out of our temporal, geographic, and disciplinary silos, and we must do so in a careful and rigorous manner, if we are to gain some understanding of the processes that continue to drive our world.

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