Specialist Meeting on

Globalization in the World-System: Mapping Change over Time

University of California, Riverside
Saturday February 7 and Sunday February 8, 2004

Organizers: Richard Appelbaum, Christopher Chase-Dunn, and Helen Couclelis

Co-sponsored by:

Center for the Spatially Integrated Social Science, University of California, Santa Barbara

University of California, Riverside:

- **Office of the Vice Chancellor for Research and Office of the Chancellor**
- **Institute for Research on World-Systems**
- **Program on Global Studies**

This workshop will bring together about thirty scholars with a substantive or methodological interest in the study of global-scale socioeconomic processes across time and space. The group will be composed of empirically oriented scholars of global social processes and several experts on geographic information science and network analysis. The purpose of the workshop is to encourage participants to develop ideas for research projects on the structure and dynamics of globalization using new research technologies such as Geographic Information Systems (GIS), spatial analysis methods (including network analysis), and sources of geographic information not usually employed by globalization researchers. Geologists, climatologists and other earth scientists have long used GIS and related methods along with geocoded data at the global scale, but social-science work on globalization phenomena that explicitly utilizes such methods is still quite rare. This workshop will bring researchers together to help generate ideas for new globalization research projects that make use of GIS methods, spatial analysis including formal network analysis, and scientific visualization techniques such as "time-mapping." [1]

Particularly relevant to the objectives of the workshop are worldwide studies of evolving social processes, and projects that explicitly compare recent global processes with those that have operated in the past. We are also interested in mapping and more generally, graphically representing the spatial scale and intensity of human interaction networks in order to study the emergence of global integration and its cross-temporal characteristics. We hope that new research projects that use novel methods developed in geographic information science will eventually emerge from the workshop.

The program will open with a keynote address by Michael Goodchild of the Center for Spatially Integrated Social Science at UC Santa Barbara, and will consist of five topical

sessions built around 15-minute paper presentations. Each topical session will have two discussants, one familiar with geographic information science concepts and methods and the other an expert on the substantive theme of each session. There will also be a final session for brainstorming about possible research projects that capitalize on new ways to study globalization using GIS and related spatial analysis techniques.

The workshop's five topical sessions will be on:

- Commodity Chains and Labor in the World Economy,
- Global Business Networks,
- Global City Systems
- Hegemony and Power Configurations in Interstate Systems, and
- Global Transportation and Communications Networks

One example of an approach to globalization studies that could greatly benefit from spatial analysis techniques and GIS is the comparative world-systems approach. This focuses on four specific kinds of social interaction networks (information, prestige goods, bulk goods, and political/military networks), each operating at a different spatial scale (Chase-Dunn and Hall, 1997). The comparative world systems approach defines its units of analysis as systemic combinations of very different kinds of societies. Multicultural systems and core/periphery relations are studied as nested systems of networks that evolve the institutions necessary for populations, polities and networks to expand. The first question thus for any region of interest is about the nature and spatial characteristics of its links with the above four kinds of interaction networks. This is prior to any consideration of core/periphery position because one region must be linked to another by systemic interaction in order for considerations of core/periphery relations to be relevant.

A good part of what has been called globalization is simply the intensification of larger interaction networks relative to the intensity of smaller ones. Structural economic globalization can be conceptualized as the extent to which international capital investments and international trade increases (or decreases) relative to the overall size of the world economy. This kind of integration is often understood to be an upward trend that has attained its greatest peak in recent decades of global capitalism. But research on trade and investment shows that there have been two recent waves of integration, one in the last half of the nineteenth century and the most recent since World War II (Chase-Dunn et al. 2000, 2002). The expansion and contraction of interaction networks in earlier world-systems needs to be studied in order to make comparisons with the waves of structural globalization that have occurred in the modern world-system. This will allow us to identify the structural and dynamic similarities and differences between different world-systems and across historical periods.

Geographical Information Systems (GIS) can play a major role in such research and in globalization studies in general, by helping analyze, forecast, and visualize the great variety of spatial interactions and networks involved in global-scale socioeconomic phenomena. These include global commodity chains, information flows, labor migration flows, financial flows, and other aspects of the global economy, as well as the relationships between such networks of human interaction on the one hand and natural environments on the other. Elegant and powerful

spatial analysis techniques can help unpack and make visible the very substantial spatial and temporal components of the phenomena of interest, be they networks or flows across the globe (see, for example, Tobler's (1995) maps of 'migration winds'). In addition to the scientific value of such techniques, GIS enables us to generate sophisticated visualizations and computer animations that are extremely useful for education and for conveying the results of globalization research to a wider public. For example, we can construct animated visualizations of how traditional social structures and interaction nets have recently changed their spatial scale to merge within the single global political economy of today.

The potential of GIS and spatial analysis for suggesting and testing causal social science models of historical development is only beginning to be tapped. Such models will involve further elaboration of the ability to represent and analyze movement and interaction networks, and the development of techniques that use change over time to test complex causal models. GIS may be combined with other techniques to better meet the objectives of globalization research. For example, Hierarchical Linear Modeling (HLM) is used to study causal interactions among different levels of nested interaction networks (e.g. communities, metropolitan areas, regions). HLM makes it possible to separate the variance into components explaining the effects of different levels of analysis (Vogt 1999). This allows us to address the questions of what relationships at which levels of analysis really are more causally powerful. The debates about whether national societies or variable characteristics of the world-system as a whole are more powerful for explaining social change are among the issues amenable to systematic analysis using HLM. There are obvious methodological issues that need to be addressed in utilizing multilevel GIS databases with historical data. Such spatial databases are naturally hierarchical with multiple levels of analysis: states, counties, cities, census tracts, or nations, regional systems of nations, and world-systems. The general comparative method of non-experimental research design assumes that "cases" (units of analysis) are independent instances of the process under study. Because spatial modeling can deal explicitly with the relations of phenomena across geographic scales, HLM in combination with GIS may allow us to determine degrees of interdependence of processes as well as the causal power of variable characteristics of different levels of analysis.

GIS can also profitably be combined with Network Analysis as developed by quantitative sociologists and mathematicians. Network Analysis is a quantitative approach to interaction networks that produces different measures of network structure and function. It includes sophisticated analytic techniques that are little known outside of mathematical sociology. Networks have also been studied extensively by geographers in the context of transportation and communication as part of the major emphasis in human geography on human interactions across space and time. Tools for studying spatial networks are by now well integrated into GIS. Linking traditional Network Analysis, which does not explicitly consider space, with geocoded data could substantially enhance the analytic tools available to those studying spatial relations and interactions at global scales.

In summary: according to many researchers, interaction networks, the empirically determinable links among people, are more important than categorical attributes for understanding the bounding of social systems at different scales. Networks allow us to examine the important ways in which the members and organizations in different societies are connected

with one another as well as the structure of subgroups within societies. Networks are inherently *spatial*. There are new techniques and tools for organizing spatial data and for analyzing nested systems that can help us to better understand historical development and social evolution. It is time that our research community begins taking advantage of these new and very promising opportunities.

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The Center for Spatially Integrated Social Science (CSISS) http://www.csiss.org/ recognizes the growing significance of space, spatiality, location, and place in social science research. It seeks to develop unrestricted access to tools and perspectives that will advance the spatial analytic capabilities of researchers throughout the social sciences. Located at the University of California at Santa Barbara, CSISS focuses on the methods, tools, techniques, software, data access, and other services needed to promote and facilitate a novel and integrating approach to social science that is *spatially integrated*. The National Science Foundation funds CSISS.

The Institute for Research on World-Systems (IROWS) http://www.irows.ucr.edu/ organizes collaborative research among social, biological and physical scientists on long-term, large scale social change and its ecological, geographical and epidemiological causes and effects. Located at the University of California at Riverside, IROWS pursues comparative research on the rise and fall of civilizations, long-term processes of globalization and climate change.

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Center for International Earth Science Information Network http://www.ciesin.org/

Center for Spatially Integrated Social Sciences (CSISS) http://www.csiss.org/

"GIS Cookbook" http://www.csiss.org/cookbook/

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1 The TimeMap® Project (http://www.timemap.net/) allows GIS maps to be used to show changes over time by defining a conceptual mapping between an explicit spatio-temporal data model (the Snapshot-Transition model) and the data actually recorded by any particular project (Johnson 2000).

Globalization in the World-System: Mapping Change Over Time—Agenda

Saturday, February 7, 2004: Institute for Research on World-Systems	
8:00 am	**Meeting Registration** at Institute for Research on World-Systems, College Building South, College Place, University of California, Riverside
8:30 - 9:45 am	**Opening Session**: Welcome: UCR Chancellor France Cordova Keynote address: Michael Goodchild, Spatial Perspectives for the Globe
10:00 - 11:45 pm	**Session 1**: **Commodity Chains and Labor in the World Economy** Presider: Helen Couclelis Presenters: Richard Appelbaum: Commodity Chains and Economic Development Jennifer Bair Beverly Silver Discussants: Thomas Reifer and David Smith
12:30 - 1:30 pm	**Session 2**: **Presentations on GIS and Network Analysis** Presenters 12:30 - 1:00 > Stuart Sweeney: Spatial Analysis 1:00 - 1:30 > Harvey Miller: Geographical Information Systems 1:00 - 1:30 > Robert Hanneman and Douglas White: Quantitative Network Analysis
1:45 - 3:15 pm	**Session 3**: **Global Business Networks** Presider: Christopher Chase-Dunn Presenters: William Carroll: Representing Spatiality in the Transnational Corporate Network Jeffrey Kentor and Harvey Miller Discussants: Douglas White and Edward Malecki
3:30 - 5:15 pm	**Session 4**: **The Global City System** Presider: Richard Appelbaum Presenters: Saskia Sassen David Smith John Weeks and Chris Chase-Dunn: The System of World Cities: Studying Suburbanization Since 1970 Satellite Imagery Discussants: Jeffrey Kentor and Stanley Brunn

Sunday, February 8, 2004: Institute for Research on World-Systems	
9:30- 11:30 am	**Session 5**: **Hegemony and Power Configurations in Interstate Systems** Presider: Thomas Reifer Presenters: Giovanni Arrighi David Wilkinson Zhiqian Yu Discussants: Robert Hanneman
12:15 - 2:00 pm	**Session 6**: **Global Transportation and Communications Networks** Presider: Michael Goodchild Presenters: Edna Bonacich Miguel Centeno Peter Hugill Matthew Zook and Stanley Brunn Discussants: Don Janelle and Giovanni Arrighi
2:15 - 4:00 pm	**Session 7**: **Roundtable Discussion of New Research Projects** Five-Minute Summary Presentations: Richard Appelbaum Christopher Chase-Dunn Helen Couclelis Michael Goodchild *Group Discussion*

Globalization in the World-System: Mapping Change Over Time—Participants

Abstracts and Papers follow the listing of Participants

Appelbaum, Richard, Sociology, UCSB
Research Interests: globalization of the apparel industry, commodity chains, global industrial relations.

Arrighi, Giovanni, Professor of Sociology and Director of the Institute for Global Studies in Culture, Power and History, Johns Hopkins University.
Research interests: comparative and historical sociology, world-systems analysis and economic sociology

Bair, Jennifer, Sociology, Yale
Research Interests: Commodity chains, trade agreements

Bonacich, Edna, Sociology, UCR
Research Interests: Globalization of the apparel and transportation sectors, labor relations.

Brunn, Stanley, Geography, University of Kentucky

Carroll, William, Sociology, University of Victoria (BC)
Research Interests: global elite networks, policy networks.

Centeno, Miguel, Sociology, Princeton University
Research Interests: Network analysis and mapping of globalization processes, geopolitics in Latin America.

Chase-Dunn, Christopher, Sociology, UCR; founder and director of the Institute for Research on World Systems (IROWS).
Research interests: cities and settlement systems; comparing the modern world-system with earlier regional systems, founder and co-editor of the electronic Journal of World-Systems Research.

Couclelis, Helen, Geography, UCSB
Research Interests: Urban and regional modeling and planning, spatial cognition, geographic information science, geography of the information society.

Goodchild, Michael, Geography, University of California, Santa Barbara and Director of the Center for the Spatially Integrated Social Science at the University of California, Santa Barbara.
Research Interests: Urban and economic geography, geographic information systems, and spatial analysis.

Hanneman, Robert, Sociology, UCR
Research Interests: Network analysis of economic sectors, mathematical modeling the growth and decline of states.

Hugill, Peter, George Bush School of Government, Texas A&M
Research interests: historical relationship between people and their environment as mediated through technology; role of transportation systems and telecommunications in the World-System; geopolitical models; role played by agricultural commodities in defining world trade flows, industrial development, and consumer markets; Anglo-America and its relationships to Europe; transition from British to American hegemony in the World-System

Janelle, Don, Geography, UC Santa Barbara
Research Interests: space-adjusting technologies: integrating information, communications, and transportation.

Kentor, Jeffrey, Sociology, University of Utah
Research Interests: transnational corporations, interlocking directorates, global networks, cross-national comparative analysis.

Malecki, Edward, Geography, Ohio State University

Miller, Harvey J, Geography, University of Utah

Reifer, Thomas E, Sociology and IROWS, UCR
Research interests: hegemony, globalization, and anti-systemic movements; comparative and world-historical sociology; social change, stratification, and inequality; sociology of development and globalization; international political economy

Sassen, Saskia, Ralph Lewis Professor of Sociology, University of Chicago
Research interests: recent five-year project on governance and accountability in a global economy (next book: Denationalization: Economy and Polity in a Global Digital Age, Princeton University Press, 2003). Major figure in the study of global cities. Co-director of the Economy Section of the Global Chicago Project, a Member of the National Academy of Sciences Panel on Urban Data Sets, a Member of the Council of Foreign Relations, and Chair of the newly formed Information Technology, International Cooperation and Global Security Committee of the SSRC.

Silver, Beverly J, Sociology, Johns Hopkins University
Research interests: problems of development, labor and social conflict, using comparative and world-historical methods of analysis. Her work recasts a variety of social issues in a broad spatial and temporal framework in order to identify patterns of recurrence, evolution and "true novelty" in contemporary processes of globalization. Forthcoming book: Forces of Labor: Workers' Movements and Globalization Since 1870 (Cambridge University Press, in press).

Smith, David, Sociology, UCI. Immediate past editor of Social Problems
Research interests: international trade and exchange in the world-economy (and its implications

for economic growth and development; global industrialization and commodity chains, especially in the Pacific Rim region, and particularly apparel and garment manufacturing; the dynamics of technological dependence and technology transfer in East Asia; Third World cities and development; global urbanization and world cities. Network analysis of global trading patterns, focusing on stratification in the world system; the analysis of air traffic flows as indicators of urban hierarchies.

Su, Tieting, Sociology, Cal-State Los Angeles
Research interests: world trade network analysis; world-systems; world trading blocks; long cycles, rise and fall of hegemony in East Asia.

Sweeney, Stuart, Geography, UCSB, CSISS Executive Committee
Research Interests: spatial statistics, urban geography

Weeks, John R, Geography, CSU-San Diego
Research Interests: Demography, health, environment, remote sensing of urban regions.

White, Douglas R, Social Science, University of California, Irvine
Research Interests: Network Analysis, World Trade structures.

Wilkinson, David, Political Science, UCLA
Research Interests: chronographing political military interactions, power configurations and prestige good trade networks over the past 5000 years.

Yu, Zhiqian, Software Engineer, ESRI, Redlands
Research Interests: GIS and Remote Sensing techniques for studying land use and climate change.

Zook, Matthew, Geography, University of Kentucky

Specialist Meeting on Globalization in the World-System: Mapping Change over Time

Abstracts and Papers

Richard P. Appelbaum, Sociology, University of California Santa Barbara

Abstract: The purpose of this paper is propose two vastly different approaches to studying the role of commodity chains in the global economy. Both use the commodity chains framework to analyze the possibilities for industrial upgrading. The first proposes to develop an index of industrial upgrading in individual countries, and then use the index as the dependent variable in causal models incorporating various predictors of industrial upgrading. The second, somewhat more adventurous strategy, proposes a commodity chains-based decision approach that would attempt to model the complex interactions between the commodity chain and its regional environment. The first approach is developed considerably more extensively than the second (which is barely developed at all), both because it builds on former work I have done with others (including David Smith, who is part of this workshop), and because it seems reasonably possible to accomplish empirically. The second approach is developed more briefly and speculatively; suggestions would be appreciated.

Commodity Chains and Economic Development: One and a Half Proposals for Spatially-Oriented Research

Richard P. Appelbaum

working paper prepared for CSISS/IROWS Specialist Meeting,

Globalization in the World System: Mapping Change Over Time

Session 1: Commodity Chains and Labor in the Global Economy

University of California at Riverside

February 7-8, 2004

The purpose of this paper is propose two vastly different approaches to studying the role of commodity chains in the global economy. Both use the commodity chains framework to analyze the possibilities for industrial upgrading. The first proposes to develop an index of industrial upgrading in individual countries, and then use the index as the dependent variable in causal models incorporating various predictors of industrial upgrading. The second, somewhat more adventurous strategy, proposes a commodity chains-based decision approach that would attempt to model the complex interactions between the commodity chain and its regional environment. The first approach is developed considerably more extensively than the second (which is barely developed at all), both because it builds on former work I have done with others (including David Smith, who is part of this workshop), and because it seems reasonably possible to accomplish empirically. The second approach is developed more briefly and speculatively, mainly because I really have no idea how to proceed further.

Before proceeding to the two proposed approaches, it is important to review the underlying theoretical frameworks, along with some recent changes in global production systems that are consequential for both approaches.

SOME THEORETICAL CONSIDERATIONS

In this section we briefly review the concept of global commodity chains, discuss the importance of social networks in an increasingly globalized economy, and briefly review the possible role of state policies in development.

Global Commodity Chains

This notion of an increasingly integrated global economy – where countries come to occupy distinct export niches and where industrial upgrading is a key strategy – can be fruitfully understood through the notion of global commodity chains, "network[s] of labor and production

processes whose end result is a finished commodity" (Hopkins and Wallerstein, 1986: 159). Global commodity chains consist of a number of 'nodes' or operations that comprise pivotal points in the production process: raw materials supply, production, export, and marketing, taking us "across the entire spectrum of activities in the world-economy" (Gereffi, 1992: 94). The study of global commodity chains, which originated with the work of sociologist Gary Gereffi and his colleagues has spawned a major cottage industry in the sociology of development.

As originally conceived by Gereffi, global commodity chains have three main dimensions: an input-output structure comprised of a set of products and services linked together in a sequence of value-adding economic activities; a territoriality that identifies the geographical dispersion or concentration of raw material, production, export, and marketing networks; and a governance structure of power and authority relationships that determines how financial, material, and human resources, as well as economic surplus, are allocated and flow within a chain. While there is a large and growing body of empirical work on all three of these dimensions, that work has consisted entirely of case studies of specific industries, most notably low-wage industries such as apparel and electronic assembly.

Gereffi has also distinguished between two distinct types of global commodity chains – those that are controlled by producers, and those that are controlled by buyers (see Gereffi, 1994, for the original formulation). Producer-driven commodity chains refer to those industries "in which large integrated industrial enterprises play the central role in controlling the production system (including its forward and backward linkages)" (Appelbaum and Gereffi, 1994: 44). This is most characteristic of capital- and technology- intensive industries dominated by transnational corporations. Buyer-driven commodity chains, on the other hand, refer to those industries

> in which large retailers, marketers and branded manufacturers play the pivotal roles in setting up decentralized production networks in a variety of exporting countries, typically located in developing countries. This pattern of trade-led industrialization has become common in labor-intensive, consumer-goods industries such as garments, footwear, toys, handicrafts and consumer electronics. Tiered networks of third-world contractors that make finished goods for foreign buyers carry out production. Large retailers or marketers that order the goods supply the specifications (Gereffi and Memedovic, 2003: 3)

This pattern of trade-led industrialization is common in labor-intensive, consumer goods industries such as garments, footwear, toys, and consumer electronics. In the current phase of globalization, abetted by revolutions in information technology and logistics, there has been a sea change in global industrial organization: Producer-driven commodity chains, which dominated during an era of Fordist production, are rapidly giving way to buyer-driven commodity chains in which giant retail conglomerates call the shots. Wal-Mart, not General Motors, is the world's largest corporation.

In buyer-driven commodity chains, profits "derive not from scale, volume, and technological advances as in producer-driven chains, but rather from unique combinations of high-value research, design, sales, after-sales services, marketing, and financial services that allow the buyers and branded merchandisers to act as strategic brokers in linking overseas factories and traders with evolving product niches in their main consumer markets" (Gereffi, 1994: 99). In other words, the highest value-added activities are often more closely associated with consumption than production. Because constant design changes for customized markets is

the primary source of competitive advantage, products have become increasingly aestheticized, emphasizing elements of style, fad, and mystique, all of which increases the contribution of design to the value of the product. Thus, design-intensive activities have increased their proportion of value generated relative to manufacture and assembly activities. So one aspect of the shift to buyer-driven commodity chains is the creation of competitive advantages through product differentiation and customization for distinct market segments, rather than merely by cutting labor costs: it is no longer possible to complete exclusively on the basis of low-cost labor. The economic success of newly industrializing nations will largely depend on their firms' ability to "move up" into these higher value-added economic activities.

A handful of peripheral countries have engaged in industrial upgrading, shifting from commodities like textiles, apparel and footwear to higher value-added, technologically sophisticated production that requires a strong and well-integrated industrial base. This was the pathway followed by the East Asian newly-industrializing economies (NIES) during the 1980s and 1990s, when regional growth rates averaged 7-8 percent annually despite escalating wages, labor shortages, and currency appreciation that threatened competitiveness in the very labor-intensive industries upon which they built their economic successes. Their pattern involved continuous technological improvement of production processes, the production of new products and the provision of new services, and otherwise engaging in higher value-added economic activities. East Asian firms were able to move up from what Gereffi terms "captive networks" (in which producers are limited to assembly of cut fabric following detailed instructions) into "relational value chains" entailing "more complex forms of coordination, knowledge exchange, and supplier autonomy," permitting full-package production, the ability to go beyond simple assembly and supply the client with a completely finished product by providing designing, sourcing, cutting, sewing, assembling, labeling, packaging, and shipping (Gereffi, Humphrey, and Sturgeon, 2003: 12).

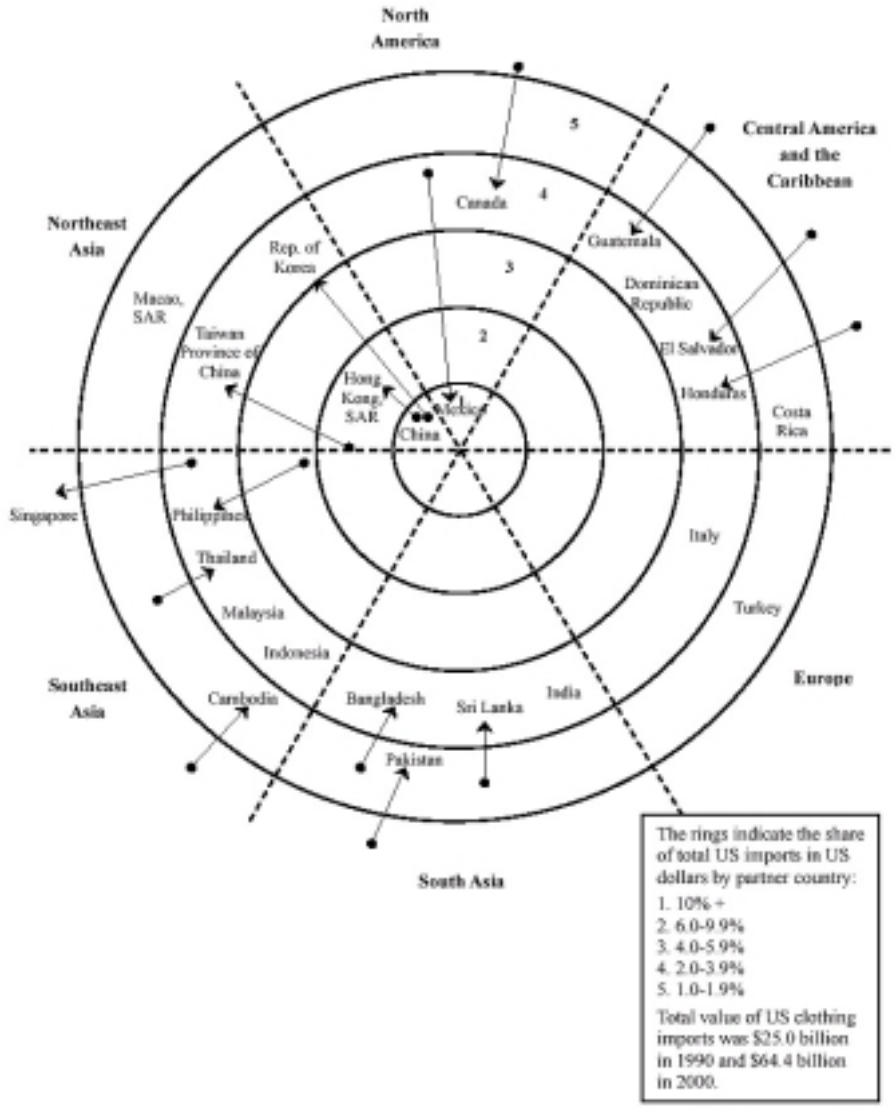
The number of leading global apparel exporting countries has increased sharply between 1980 and 2000, with many formerly lower-tier countries "moving up" the commodity chain into higher value-added activities. Countries whose apparel exports exceeded US$1 billion in 1980 included only the East Asian NIEs (Hong Kong, Taiwan, and South Korea), along with China and the U.S. A decade later, the list also included Indonesia, Thailand and Malaysia; India and Pakistan; Turkey (which had emerged as the world's fifth-largest apparel exporter); and Tunisia. By 2000, the list included the Philippines and Viet Nam; Bangladesh and Sri Lanka; Morocco and Mauritius; four East European countries; and of course Mexico, who apparel exports had grown from virtually nothing in 1990 to $9.3 in 2000. In that year the top five apparel exporters were China ($39.2 billion), Hong Kong ($24.7 billion), the United States $9.3 billion), Mexico ($9.3 billion), and Turkey ($7.0 billion). Yet there remains substantial variation in the degree to which apparel remains a principal export item among the world's 25 largest apparel exporters:

> In Northeast and Southeast Asia, [apparel] has declined in importance, except in China where it remains the top export item, and in Indonesia and Viet Nam where apparel has climbed to third place. However, in South Asia, Africa, the Caribbean Basin and Central and Eastern Europe, apparel is the leading export, and frequently has been for a decade or more. (Gereffi and Memedovic, 2003: 26)

If one looks at changing geogrpahical patterns for U.S. apparel imports (see Figure 1) during the past decade, it is clear that Northeast Asian countries are declining in importance,

South and Southeast Asia have stabilized, and China, Mexico and to some extent the Caribbean Basin have increased; only China and Mexico are core suppliers, however. For most countries there was little change between 1990 and 2000 (Mexico being the principal exception, thanks in large part to NAFTA). The countries that have been most successful in exporting to the U.S. are those that do not engage in simple assembly, but have developed, or are developing, full-package production capabilities – Hong Kong, Taiwan, South Korea in the first instance, China and Mexico in the latter.

Figure 1: Shifts in the regional structure of United States' apparel imports, 1990-2000*



*Note: The 2000 position corresponds to the ring where the country's name is located; the 1990 position, if different, is indicated by a small circle. The arrows represent the magnitude and direction of change over time. Source: Gereffi and Memedovic, 2003: p. 18

Social Networks: Personal Ties and Spatial Proximity

Although labor costs often are a crucial component of the calculations of businessmen

and investors, other factors (such as market proximity, access to skilled labor, and trade barriers) also figure in decision-making about industrial location (Dicken, 2003). One sent of important factors has to do with social networks. Two different (although often overlapping) types of social networks haved receive prominent attention in the development literature: those stemming from personal ties and connections, and those stemming from spatial proximity.

Personal Ties: The ability of firms to create informal business networks in service of global production has received extensive attention in the development literature, and is believed by some scholars to be a key ingredient in East Asia's economic success. Chinese businesses in particular are said to prosper as a result of their reliance on informal personal networks and connections – *guanxi* obligations of mutual obligation and reciprocity that are frequently mediated through family or community ties. Integration tends to be horizontal and informal, rather than vertical and contractual, with horizontal coordination based on short-term needs rather than long-term obligations. Firms can therefore remain small and more responsive to quickly changing market conditions, while at the same time gaining access to the large capital, resource, and information pools of the business group. Such informal alliances between firms in business groups allow the network as a whole, rather than individual firms, to organize and manage a large portion of the commodity chain. Rather than using vertical integration to solve problems of opportunism and information flow, these problems are managed through interfirm trust and communication. Firms can therefore remain small and more responsive to quickly changing market conditions, while at the same time gaining access to the large capital, resource, and information pools of the business group (Orru, Biggart, and Hamilton, 1992; Hamilton and Kao, 1990; Smart and Smart, 1991; Lui, 1998; Gerlach, 1992; Whitely, 1992, 1996; Appelbaum, 1998; Cheng, 1993; Chan, 1993; Walton, 1993; Birnbaum, 1993; Appelbaum, Felstiner, and Gessner 2001).

Spatial Proximity: The agglomeration effects associated with spatially concentrated, tightly integrated metropolitan regions ("industrial districts") are believed to confer competitiveness by permitting a quick and flexible response to rapidly-changing market demands. Such flexibility, which results from the transactions-intensive production and supply networks, results in a shift away from standardized assembly-line mass production to much more flexible, segmented production. Industrial districts confer competitive advantage through externalities resulting from the physical presence of numerous suppliers and producers, concentrated in geographically interdependent networks of small firms, factories, and specialized local labor markets. Information flow is facilitated by family connections, personal relationships, professional and community-based ties, trade associations, tight lines of communication between neighboring suppliers, and common culture. Such flows permit a highly flexible organization of production, with quick response to shifts in market demand. Transaction costs are lowered through proximity to markets, the ability to quickly acquire producer goods and services, lowered transportation and communications costs, access to suppliers, and in general the rapid exchange of information and knowledge (Scott, 1988; Storper and Walker, 1989). The presence of a strong support infrastructure – for example, business associations, supplier clubs, and private or state-supported research and development facilities – can also contribute to globally competitive firms. There is also some evidence that small- and medium-sized enterprises may be better able to respond flexibly to changing market conditions than large ones, particularly if informally networked into strong business groupings (Doner and Hershberg, 1996).

The Role of State Policy

Firm and industry characteristics by themselves do not account for successful upgrading. Both unique historical circumstances and state policy also contribute to economic growth. In East Asia's rapid development during the 1970s-1990s, for example, the Cold War funneled vast amounts of foreign aid into the region, while the "long boom" in the core economies during the 1950s and 1960s provided markets for exports (Appelbaum and Henderson, 1992). Developmentally-oriented state bureaucrats sought legitimacy by pursuing policies intended to raise overall living standards. As Evans (1995) has demonstrated with regard to the South Korean information technology industry, becoming a global competitor can benefit from the interventions of an activist state (what Evans refers to as 'entrepreneurial bureaucrats') that is strongly connected to social and political groups committed to development.

Examples of state policies that promoted development include maintaining low wages through the labor repression in South Korea, Taiwan, and Singapore; large-scale underwriting of a social wage in the form of extensive public housing schemes in Singapore and Hong Kong; investment in education and training throughout the NIEs; and various forms of industrial policy during the latter phases of export-led growth and secondary import substitution in South Korea, Taiwan, and Singapore. Examples of industrial policy included credit control and price-rigging as a means to prod companies into higher value-added, higher wage and more technology-intensive forms of production; enforced savings, as exemplified by Singapore's Central Provident Fund; public investment in the creation and refinement of new technologies, such as government R&D centers whose results were made available to private companies; state creation of industrial sectors that did not previously exist either through state companies or through the supply of credit and financial guarantees to private companies; and state discouragement of speculative domestic or overseas investment, thus indirectly ensuring its flow into manufacturing. Occasionally developmental policies even called for direct state ownership of key industries – for example, banks in South Korea, or airlines, armaments, ship-repairing in Singapore (see the writings in Appelbaum and Henderson, 1992; Henderson and Appelbaum, 1992; Henderson, 1993; Evans, 1987, 1995; Amsden, 1989; Wade, 1990).

RECENT CHANGES IN GLOBAL PRODUCTION

There are two relatively recent developments in global production that have must be taken into account in any effort to model the possibilities for economic development, because both modify the prospects for industrial upgrading through movement up the commodity chain. The first is the growing power of large retail multinationals; the second the emergence of a stratum of giant multinational factories that are increasingly playing the role of intermediaries between manufacturers and retailers on the one hand, and labor on the other.

The Growing Importance of Large Retailers

One of the principal changes in global apparel commodity production has been the growing economic power of giant retailers, who exert growing control over prices and sourcing locations, both through price pressures they exert on the independent labels they carry, and through their growing volume of private label production (now estimated to encompass as much as a third of all U.S. retail apparel sales). As Hamilton and Kotha (2003: 2-3) describe it,

> the event of crucial historical importance was the "retail revolution" of 1965-1980 which created mass merchandising giants such as Wal-Mart, K-Mart, and Target; and, later,

specialty retailers such as Home Depot, Best Buy, Circuit City, and Office Depot, which today, together with the earlier established Sears, Penney's, and major grocery chains, procure a substantial amount of products sold to final consumers. The success of these discount general merchandisers and "category killers" also provided a context for the success of specialized distributors, marketers, and assemblers such as Nike, The Limited, Dell, and Gateway; as well as for an increasingly intermediary position of major manufacturers and technology innovators such as AT&T, GE, Compaq, and HP. Internet-based retailing, which took off in the last five or so years, most likely represents another "revolution" in distribution with profound effects on the consumer-oriented industries.

Giant retailers have grown in size to surpass the largest manufacturers in terms of revenues. Among retailers, the U.S. dominates the world, and Wal-Mart dominates the U.S. The four largest U.S. retailers account for about a tenth of total U.S. retail sales. The world's 40 largest retailers accounted for nearly $1.3 trillion in revenues in 2001, nearly 4 percent of the world GDP (derived from Fortune, 2002). Among the top forty, twelve are based in the U.S. accounting for nearly half (43%) of total sales; almost all the rest are from the EU (accounting for 46%). The only Asian firms in the top forty are five Japanese retailers (accounting for 11%). Wal-Mart accounts for nearly a fifth of the combined sales of the top 40, more than three times those of its nearest competitor, France's Carrefour. In fact, Wal-Mart's 2002 revenues of $246 billion made it the world's 18th largest economy, roughly tied with Switzerland. In the last few years the giant retailer has surpassed Exxon, General Motors, British Petroleum, and Ford Motors in revenues, signaling the rising power of retailers in the world economy. This suggests an important emerging dynamic in the global economy: the US and EU overwhelmingly control the retail end, at a time when retailers in general are exerting increasing control over the global economy (Appelbaum, forthcoming 2004).

In terms of labor, the dominance of giant retail transnationals poses a significant challenge to working class organization, since their buyer-driven commodity chains are characterized by extreme post-Fordist production involving networks of global outsourcing and high levels of capital mobility. In the classical global buyer-driven commodity chain formulation, retailers have disproportionate control over the manufacturers who design the goods they sell and the factories where those goods are made (Appelbaum and Gereffi, 1994; Gereffi, 1994, 2001). The Gap, to take one example, sources from 4,000 factories in 55 countries; Disney, to take another, from 30,000 factories. Because these giant firms can place their orders anywhere on the planet they choose, their contractors are seen as relatively powerless price-takers, rather than partners and deal-makers. The effects on labor of this arrangement are mixed: one outcome is the "race to the bottom," where retailers and manufacturers play off competing contractors to force prices (and wages) down and thwart unionization drives. Another outcome, however, is that if large retailers and manufacturers can be made to pressure their suppliers by consumer pressure, gains for labor can also be achieved – as occurred in Mexico's Kukdong (Mexmode) factory and the Dominican Republic's BJ&B cap company.

Large retailers characteristically have large volume requirements, leading them to only consider large producers (1000+ workers) as potential suppliers. In the words of one African supplier, success requires "never deviating from a chosen product type, not trying to be versatile, seeking efficiency on single styles and going for longer and longer runs" (Gibbon, 2003: 33).

Related to these trends, since the mid-1980s, there has been a move toward "lean retailing," particularly in the U.S. but also in Europe and Japan. Traditionally, apparel producing firms and retailers were relatively independent of one another. Led by Wal-Mart and other large U.S. retailers, and enabled by technological changes that permitted a high degree of data sharing and other electronic interchanges, retailers increasingly brought their suppliers under much more direct control, requiring them to "implement information technologies for exchanging sales data, adopt standards for product labeling, and use modern methods of material handling that assured customers a variety of products at low prices" (Abernathy *et al*, 1999: 3). Such changes in retailing favor Hong Kong, Taiwanese, and South Korean garment firms (Gereffi, 2003), who are well positioned to manage triangle manufacturing (so-called because a foreign buyer places an order with an East Asian firm which manages the production, completing the triangle by shipping the goods to the foreign buyer; see Gereffi and Pan, 1994: 127). As Thun (2001: 15) notes in his study of Taiwanese firms,

> small, local firms in Southeast Asia or mainland China may be able to undercut a Taiwanese firm on labor costs, but they are unlikely to be able to make the investments in electronic data interchange that make rapid response possible. In short, being able to handle electronic orders from buyers, effectively forecast, plan, track production, and manufacture apparel quickly and flexibly, are skills that provide a far more enduring form of comparative advantage for Taiwanese firms than constantly scouring the globe for the lowest cost labor.

One study of European retailing (focusing on Britain, France, and Scandinavia) found that Scandinavian retailers tended to concentrate their purchases among a relatively small number of foreign suppliers, while French retail sourcing was more dispersed (British retailers were in between). The study identified three different models of supply base management (Palpacuer, Gibbon, and Thomsen, 2003):

- a rules-based *UK model* emphasizing rationalization of the supply chain through formal supply chain management (SCM) doctrines, with specialized functions centralized at corporate headquarters
- a market-based *Scandinavian model* emphasizing concentrated sourcing networks, achieved by establishing strong personal relations with overseas manufacturers
- a socially-embedded *French model* emphasizing more open, informal, and dispersed sourcing networks

The growing size and dominance of larger EU and U.S. retailers suggests an important dynamic in the world economy: the experience of Hong Kong, Singapore, Taiwan, and South Korea – newly-industrializing economies that relied on apparel and textile production as integral parts of successful development strategies – may prove difficult to replicate in a world where the retail end is much more tightly controlled today than it was 20-30 years ago.[1] Only countries with sizeable internal markets, such as China and India, may prove capable of moving up the apparel chain into higher value-added activities, insofar as they are able to capitalize on their internal markets in developing indigenous retail capabilities.

[1] There are other factors which make it less likely that other countries will be able to replicate the original East Asian experience. For a more complete discussion, see Henderson and Appelbaum (1992).

The Growing Importance of Major Producers

This system of retail dominance is being challenged somewhat by the rise of global contractors, typically from South Korea or Taiwan, many of whom began as small local producers in their home countries, using their know-how to go multinational. A handful of these have grown to giant size, where they often have as much power as all but the largest retailers, constituting still another layer of price-making and profit-taking. Consider, for example, the following examples of giant global contractors:

- Nien Hsing Corporation, a Taiwanese multinational that employs more than 20,000 workers in five Central American factories, as well as thousands of workers in a Mexican factory and two in Lesotho. Founded in 1986, Nien Hsing is currently the world's largest jeans maker, with an output of 40 million pairs in 2000, making jeans for Wal-Mart, JC-Penny, K-Mart, the Gap, Sears and Target. It is also the sixth-largest denim maker, producing 60 million yards per year.
- Yupoong, Inc., a South Korean multinational, which is the world's second largest cap manufacturer, exporting their "flexfit" hats (motto: "worn by the world") to some 60 countries. Yupoong (2003) operates the BJ&B hat factory in DR, the scene of the second recently successful labor struggle that we will consider, as well as Dhakarea Ltd. in Bangladesh.
- Boolim, a South Korean multinational that was founded in 1994 by Y.S. Lim, who had headed up Macy's in South Korea for 14 years. Boolim makes athletic, casual wear, and knitwear in some countries, including China, Indonesia, Sri Lanka, Bangladesh, Saipan, Thailand, Philippines, Malaysia, Myanmar, Guatemala, Mexico, Dominican Republic, Nicaragua, Honduras, El Salvador and Vietnam Its clients include Nike, Polo Ralph Lauren, Kenneth Cole, Calvin Klein, and NBA Properties.
- Pou Chen, a Taiwanese multinational, is 50% owner of Tue Yen Industrial, a Hong Kong-listed shoe manufacturer that is the world's largest, employing 150,000-170,000 workers worldwide. Yue Yen, which makes shoes for Nike (about half of its total production), as well as adidas-Saloman, Reebok, New Balance, Asics Tiger, Converse, Puma, Keds, Timberland, and Rockport, controls 17% of the world market. Most of its shoes are made in low-cost factories throughout southern China; its Yue Yen II factory complex in Dongguan, China, employs more than 40,000 workers. The company is Nike's biggest supplier, providing 15% of Nike's shoes, with one Indonesian factory turning out a million shoes a month for Nike. The company's Huyen Binh Chanh mega-factory in Vietnam will be the largest footwear factory on the planet, employing 65,000 workers (Bailey, 2003; Boje, 2000).

One study of changing patterns of imports to Britain, France and Scandinavia concluded that as recently as the late 1980s, southern Europe (mainly Portugal and Italy) was by far the leading source of imports to the three countries combined. Today the picture is far different:

> …by 2000, this picture changed so that Asian and 'greater European' producers were of roughly equal significance, ahead of their Southern European counterparts…. Importing countries' increasing dependence on a combination of 'low price' and 'medium price/short lead time' producing countries lends support to the idea that there are now

> commonly acknowledged 'global production centres'… Factors to do with history, language and proximity play a role in determining the weight that specific supplying countries and regions enjoy in specific end-markets, even within this framework (Palpacuer, Gibbon, and Thomsen, 2003: 7-8).

Finally, it should be noted that the growing importance of giant producers may paradoxically be facilitating worker organizing, since the large factories are vulnerable to pressure from the large retailers and manufacturers that use them. A number of successful unionization drives have occurred in such factories in recent years, including the Kukdong (now Mexmode) apparel factory in Mexico, the BJ&B hat factory in the Dominican Republic (owned by Yupoon); and Hien Hsing factories in Mexico (Chentex) and Lesotho. In these examples, pressure on the factories and their clients (which included Nike, Reebok, the Gap, and other major U.S. companies) by local independent labor unions, supported by U.S. and EU unions and NGOs, have caused the parent companies to allow the formation of independent unions.[2]

ESTIMATING THE DETERMINANTS OF INDUSTRIAL UPGRADING

One approach would empirically estimate the circumstances under which labor-intensive industrialization – which played a key role in the early development of the growing economies of East Asia – contributes to economic development. It builds on my earlier work with David Smith, Brad Christerson, and Herbert Wong (see, for example, Appelbaum, Smith, and Christerson, 1993; Appelbaum, Smith, and Wong, 1998).

Measuring Industrial Upgrading

Appelbaum, Smith, and Wong (1998) suggested developing an index of industrial upgrading in individual countries, estimating causal models using the index as the dependent variable. We proposed analyzing exports from all non-core developing countries to the United States for 35 period 1965-2000, at the broad (two-digit) SITC level, in order to discern different paths of industrial transformation, as well as conducting a more nuanced analysis of highly specific trade flows for two commodities, apparel and consumer electronics.

'Moving up the value chain' is typically taken to mean that producers adopt more capital-intensive processes and techniques, while at the same time switching to the production of more sophisticated and expensive 'high-end' goods. Measuring this type of change would capture an important component of industrial upgrading. Fortuitously, international trade data are available on a yearly basis from the United Nations that provide standardized comparable information across a range of countries. Data are coded using the hierarchically ordered Standard International Trade Classification (SITC), which allows us to examine a level of detail ranging from either very broad (one- or two- digit categories) or extremely specific (seven- to nine-digit categories). These data also include information on the unit volume and dollar value of the international commodity flows.[3] Smith and Nemeth (1988) attempted to empirically sort commodities into 'bundles' of exports which flow together in the circuits of world trade. By factor analyzing all bilateral trade for every country with a population greater than one million which provides complete import and export data, they identified five major groups or "bundles"

[2] For more detailed discussion see Espenshade, 2003, forthcoming.

[3] For a general discussion of the data see Nemeth and Smith, 1985; Smith and White, 1992; for specific examples see Appelbaum, Smith, and Christerson 1993.

of two-digit commodities (from food products and low wage/light manufacture to hi tech/heavy manufacture; see Smith and Nemeth, 1988: Tables 2 and 3).

The Smith/Nemeth strategy could be replicated, but using international commodity trade data for all countries in the most recent year available (the Smith/Nemeth analysis relied on 1980 data). This would provide one measure of the level of upgrading that characterizes a country's exports. It is important to note that this operationalization of upgrading is partial. One of the key insights of the commodity chain approach is the importance of considering non-production aspects such as design, distribution and marketing of final products. Data classifying manufacturing output, even if it is by very specific product types, does not offer direct evidence about the extent to which there is a move to local design or brand name marketing.

Measuring Changing Export Profiles

The analysis of commodity trade from non-core nations to the US between 1965 and 2000 would yield a detailed image of how each country's export profile has changed over the last 35 years, revealing differences in the path of industrial transformation between countries. This in turn would provide a gauge of changing commodity export mixes that reflect the ebbs and flows of technologically-driven and fashion-related product cycles. There are a number of possible measures that tap into dimensions of the production side of industrial upgrading, which can be arrayed from the simplest to the most complex:

a. Changing average unit value of trade in all products.

b. Changing average unit value amount for major product groups. A simple analytic strategy would be to compare the changing production levels of different commodities (at either grouped, generic, or very specific-levels of classification) by calculating autocorrelation models of changes in either volume or value over the 35 year period (or any shorter periods). The coefficient of the time variable estimates the annual growth rate for that type of export (cf. O'Hearn 1994).

c. Changing index of dissimilarity, calculated from the largest fifteen two-digit SITC categories in each country. This measure gauges export diversification: countries undergoing industrial upgrading should have a higher degree of dissimilarity over time. Both weighted and unweighted measures could be constructed in a range between 0 and 100.

d. Changing concentration measures, also calculated from the largest fifteen two-digit SITC codes for each country. This measure gauges export specialization: countries undergoing industrial upgrading are likely to have a lower degree of concentration over time. This measure also ranges from 0 to 100.

e. Changing index of industrial transformation, calculated using recalibrated Smith-Nemeth "bundles." This measure is defined as the total value of export in hi-tech/heavy manufacture to low wage/light manufacture. For countries undergoing industrial upgrading the index should increase over time.

There should be major differences between countries on these indices. In particular, the established East Asian NIEs are likely to stand out with a steady pattern of upgrading over almost the entire period. Has the upward arc slowed or stagnated in light of the East Asian slowdown of

1997-8? One would expect the second-tier East and Southeast Asian NIEs to begin this process later and to score more modestly, with latecomers like China and Vietnam starting their upgrading even later (but, perhaps, to have particularly steep recent increases). It will be of great interest to determine whether the various latecomers simply follow a trajectory that replicates the initial group of NIEs, whether their upgrading is more rapid and skips stages. Finally, it should be possible to determine whether there is a distinctive "Asian model" that is distinguishable from less-developed countries in other regions, like Latin America or Africa.

Analysis of Upgrading in Apparel and Consumer Electronics

A more fine-grained analysis of upgrading is possible using seven- and nine-digit SITC categories, focusing in particular on apparel and consumer electronic assembly. Data could be analyzed for the period 1965-2000 for all non-core countries, in order to facilitate a comparison with the East Asian NIEs, since both of these industries served as critically important motors of export-led industrialization in that region.[4] In apparel manufacture, Hong Kong and Taiwan moved from sewing, to sourcing offshore production for U.S. and European designers; they are now moving up into designing and marketing branded labels themselves. A similar process has occurred in South Korea and Singapore's consumer electronics industries, where the movement has been from component assembly to engineering and design. It seems reasonable to assume that these two industries are playing the same role throughout East and Southeast Asia, and may potentially play this role in other countries.

Yet apparel and consumer electronic assembly differ in significant ways as well: unlike electronic assembly, apparel production remains greatly resistant to technological upgrading (Taplin, 1989, 1994; Bonacich and Appelbaum, 2000; Waldinger, 1986; Dicken, 2003). The principal technological changes have been in automated fabric cutting, specialized operations such as embroidering and button-holing, and electronic point-of-sales (EPOS) inventory systems. Organizationally, a few factories have replaced the bundling system with unit production, thereby reducing the time spent on handling. Second, both industries are characterized by flexible production systems, which are themselves viewed by many theorists as an important key to global competitiveness (Storper and Walker, 1989; Scott, 1988; Malecki, 1991). Insofar as flexibility calls for simultaneously minimizing production costs while rapidly responding to frequent demand, it has strong appeal in industries with tight coordination between design, production, and marketing (Dicken, 2003). In both industries, the need for flexibility translates into layers of subcontracting in which manufacturer-designers contract to numerous factories, resulting in an uncoupling of the various components of manufacturing. This disintegrated form of flexible accumulation greatly increases the importance of personal networks, which is another feature of economic development we wish to investigate.

One approach would therefore be to construct 35 year sequences of export profiles to the United States for all countries, with special attention given to those in East and Southeast Asia. One would expect varying degrees of upward movement across different countries, as well as across specific commodities. Previous research suggests that export-oriented manufacturing

[4] The simplicity of this equation and the wide availability of worldwide cross-national on trade and GDP make this feasible. The ten East and Southeast Asian countries include the Four Tigers (Hong Kong, Singapore, South Korea and Taiwan) and six latecomers (China, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam).

economies, particularly as they move beyond the most labor intensive, low value-added , manufacturing, are likely to move toward more specialized export niche production to bolster international competitiveness. This sort of commodity-specific pattern, likely to be obscured by the aggregation of products into broad export categories, should manifest itself in this finer-grained analysis. It is also likely that the rate of upgrading in either of these specific sectors will vary over time within each country. A careful examination of such patterns would make it possible to discern the developmental sequences that each country has followed. These sequenced paths of upgrading, graphed across the years, could be used to make some interesting comparisons between countries. For instance, a retrospective look at patterns of apparel or electronics upgrading in South Korea or Taiwan from the 1970s could be compared to more recent changes in China or Vietnam.

The use of time-series data permits thus makes it possible to quantitatively assess the determinants of upgrading. One strategy would involve pooled panel regression in order to estimate models that control for the initial values of the dependent variable while assessing the impact of the independent variables over time.[5] Based on the preceding discussion, the principal independent variables for this analysis might include:

1) Firm competitiveness, as indexed by average measures of labor cost and productivity, quality, reliability, etc (some of these ratings may have to be subjectively based on the perceptions of experts familiar with the industries of different countries)
2) Time-to-market (this would be one principal spatial component of the model – estimating the relative importance of spatial propinquity in commodity flows, looking, for example, at changing regional patterns of import-export relations)
3) The degree to which highly networked, spatially concentrated industrial districts exist that reduce transaction costs and enable firms to engage in all aspects of production (measuring this and estimating effects would provide another spatial component of the model)
4) The social organization of a country's firms into mutually supportive networks of producers and suppliers, in particular the presence of informal (e.g., Chinese) business networks (operationalizing this could be difficult; at worst, dummy or simple ordinal variables could be developed as subjective measures based on existing research)
5) The role of retailers relative to manufacturers as the principal customer for exports from each countries (suggestions for estimating this would be welcome; I can find no systematic source of data on this, although information could possibly be gleaned – laboriously – from the annual reports of publicly-traded retailers and manufacturers)
6) The relative importance of transnational producers in each country's factory sector (this would require a country-by-country survey of knowledgeable experts)
7) Changing trade barriers, including preferential trade agreements such as the North American Free Trade Agreement (NAFTA), the African Growth and Opportunity Act (AGOA), the Caribbean Basin Trade Partnership Act (CBTPA), and the Andean

[5] The dependent variable, Y_t, is regressed on itself at the earlier point in time, Y_{t-1}, as well as on the independent variables, $X_{i(t-1)}$.

Trade Preferences Act (ATPA). These could be incorporated by means of dummy variables, or perhaps ordinal measures reflecting experts' perception of their impact on trade

8) State role, as indexed by the proportion of government spending in business, infrastructure, and education; the extent of national industrial policy (most likely these would be dummy variables intended to capture the degree of marketization vs. central planning, based on the characterization of these economies in the literature)

9) The role of labor, in particular the presence of an independent labor movement, strikes and work stoppages, etc.

Secondary variables of substantive interest could include:

10) Flexibility/adaptability, as indexed by the average manufacturing firm size; market concentration; and percent of GDP generated by SMEs

11) Human capital development, as indexed by the percentage of the adult population with secondary education or more; the percentage of the population with tertiary education; and the percentage of the population with technical/engineering education

12) Foreign penetration: ratio of FDI/DBI

13) Domestic economic conditions, as indexed by the absolute size of the economy (an index of the size of the domestic market), domestic savings rates; the unemployment rate; the ratio of public to private investment ratio; the percent GDP that is generated by exports

14) Entrepreneurship, as indexed by the percent of the working population that is self-employed; and the new business start-up rate

15) Demographic characteristics, such as the age structure of the population which could effect workforce participation

Contrasts between Hong Kong, Taiwan, Singapore, and South Korea, China and Vietnam, and the other East Asian countries are of obvious interest. These sorts of comparisons (and separate country-by-country analysis) can be carried out either by using dummy coding or comparing parameter estimates from separate equations of sub-samples.

A COMMODITY CHAINS-BASED DECISION APPROACH TO MODELING INDUSTRIAL UPGRADING

The global commodity chains framework lends itself to a decision model approach to understanding the determinants of a firm's locational decisions (i.e., to move production to – or out of – a particular location), the regional impacts of those locational decisions, and the impact of any resulting regional changes on subsequent decisions. To my knowledge this approach has never been attempted (which probably says something about its feasibility, if not its merit). In this final section I schematically outline such an approach, in hopes that someone will discern a plausible modeling and research strategy. The basic logic would be as follows:

1. Construct a hypothetical global commodity chains for a product, modeled on the actual structure of any existing firm - for example, the U.S.'s largest apparel retailer, The Gap (with 2003 sales of $14.5 billion). One would begin by mapping out all of the networks on the commodity chain. In the apparel commodity chain, for example, on Gereffi and Memedovic (2003) have identified five categories of networks: those having to do with raw material inputs (both natural and synthetic fibers), components (yarn, fabrics, petrochemicals, synthetic fibers), production (divided into different geographic regions), export (branded companies, overseas buying offices, trading companies), and marketing (department stores, specialty stores, mass merchandise chains, discount chains, and off-price outlets).
2. Conceptualize each of these networks as a set of decisional nodes. For example, if the hypothetical firm is engaged in making a part cotton / part synthetic blouse, it needs to make decisions about where to source the cotton; where to source the synthetics; where to acquire bolts of fabric; where to assemble the blouse; etc.
3. Each hypothetical decision-maker then conducts an "environmental scan," looking at different locational options for the activity in question. Should garment assembly be done in a contract in Los Angeles? Mexico? Bangladesh? China? Model the determinants of this decision, based on what we know about such decisions. The model would incorporate such factors as labor costs and productivity, labor militancy, the presence (or absence) of labor unions, production quality, transportation costs, time-to-market (including reliability), preferential trade treatment, the presence (or absence) of large producer transnationals, the presence of supportive social networks and viable industrial districts, state policies, etc. In other words, all of the predictors that are considered in the previous approach to estimating the impact of industrial upgrading.
4. Assume a set of locational decisions, based on the foregoing considerations, for each decisional node. Begin by focusing on assembly, which is the most crucial node from an economic development perspective. Model the impact of each decision on the location that is chosen. One set of impacts would have to do with industrial upgrading – for example, prospects for the development of indigenous full-package production capabilities, the development of local backward and forward linkages in the commodity chain, including developing textile suppliers at one end, and original brand manufacturing (OBM) capabilities on the other. The other set of impacts would have to do with labor – for example, the effect on wages, inequality, and labor militancy.
5. Taking these impacts on the chosen location into account, what is the likely feedback on the decision-maker in that particular node of the commodity chain? At what point does the retailer or manufacturer decide to move production elsewhere? What are the determinants of such a decision (for example, local labor shortages, that result in rising wages)? What could be done locally to discourage such a decision?
6. Calibrate the accuracy of the model by comparing its results with actual results in comparable production systems over the past decade.
7. Repeat with other commodity chains – for example, in a capital intensive industry (e.g., automobile manufacture), or a labor-intensive industry that is more capital-intensive than

apparel manufacture (e.g., footwear). Aggregated across firms, what does this approach tell us about the prospects for industrial upgrading?

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Capitalism is the first and only historical social system that has become truly global in scale and scope. Mapping this transformation over time is a particularly challenging task. I have no disagreement with Christopher Chase Dunn's and Thomas Hall's contention that the world capitalist system–like other world-systems–can be described by means of four kinds of social interaction networks, each operating at a different spatial scale: bulk goods networks at the smallest scale, prestige goods and information networks at the largest scale, and political-military networks at an intermediate scale (1997: 52-55). This is a useful and illuminating proposition, and there can be little doubt that a mapping of these networks over time for the world capitalist system would provide compelling evidence of its peculiar expansionary character in comparison with all other world systems.

Spatial and Other "Fixes" of Historical Capitalism[1]

by

Giovanni Arrighi

Capitalism is the first and only historical social system that has become truly global in scale and scope. Mapping this transformation over time is a particularly challenging task. I have no disagreement with Christopher Chase Dunn's and Thomas Hall's contention that the world capitalist system–like other world-systems–can be described by means of four kinds of social interaction networks, each operating at a different spatial scale: bulk goods networks at the smallest scale, prestige goods and information networks at the largest scale, and political-military networks at an intermediate scale (1997: 52-55). This is a useful and illuminating proposition, and there can be little doubt that a mapping of these networks over time for the world capitalist system would provide compelling evidence of its peculiar expansionary character in comparison with all other world systems.

Granted this, the resulting spatial-temporal map would provide little information concerning the inner dynamic of historical capitalism. It may even obscure the processes that have been associated with its globalization over the last half millennium. Worse still, this globalization has occurred through a tremendous increase in the number and variety of each kind of network, as well as an increase in the scale of bulk goods and military-

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political networks relative to prestige goods and information networks. Without some theoretical guidance in the selection of the networks to be mapped, there is a real risk of producing maps that are so confusing as to be worthless.

The purpose of this paper is to propose a *conceptual* map focused specifically on the processes associated with the globalization of historical capitalism. This is not the kind of map that this conference advocates. It is nonetheless a first necessary step in the identification of the kind of geographic and historical information that is needed in order to represent graphically the spatial-temporal dynamic of historical capitalism. I shall begin with a brief discussion of David Harvey's (2003) concepts of "spatial-temporal fix," "switching crisis," and "accumulation by dispossession." I will then show that these concepts find a close correspondence in the evolutionary pattern of world capitalism identified in *The Long Twentieth Century* (Arrighi 1994) and developed further in *Chaos and Governance in the Modern World System* (Arrighi and Silver 1999). I will conclude by pointing to the kind of geographic and historical information that would be most useful to represent graphically this evolutionary pattern and the resulting globalization of historical capitalism.

I. Spatial Fixes, Switching Crises, and Accumulation by Dispossession

In seeking a connection between processes of capital accumulation and expansionist political-military projects–such as the *Project for the New American Century* that has inspired the US War on Terrorism and the invasion of Iraq–Harvey has deployed a

complex conceptual apparatus, the center-piece of which is the notion of spatio-temporal fix. In his argument, the term "fix" has a double meaning.

> A certain portion of the total capital is literally fixed in and on the land in some physical form for a relatively long period of time (depending on its economic and physical lifetime). Some social expenditures (such as public education or a health-care system) also become territorialized and rendered geographically immobile through state commitments. The spatio-temporal 'fix', on the other hand, is a metaphor for a particular kind of solution to capitalist crises through temporal deferral and geographical expansion. (2003: 115)

Temporal deferral and geographical expansion "fix" the overaccumulation crises that arise from the chronic tendency of capital to accumulate over and above what can be reinvested profitably in the production and exchange of commodities. As a result of this tendency, surpluses of capital and labor are left unutilized or underutilized. The incorporation of new space into the system of accumulation absorbs these surpluses in two ways. At first, it promotes their utilization in the activities involved in opening up the new space and endowing it with the necessary infrastructure, both physical and social. And then, once the new space has been adequately "produced," the surpluses of labor and capital can be absorbed in the new productive combinations that have been made profitable by the spatial enlargement of the system of accumulation (Harvey 2003: 109-112).

As Harvey notes, this metaphorical meaning of spatial-temporal fix as solution to capitalist crises can and recurrently does enter into contradiction with the material meaning of the expression. For the geographical expansion, reorganization, and

reconstruction that absorb surplus capital and labor "threaten... the values already fixed in place (embedded in the land) but not yet realized." Hence,

> The vast quantities of capital fixed in place act as a drag upon the capacity to realize a spatial fix elsewhere.... If capital does move out, then it leaves behind a trail of devastation and devaluation; the deindustrializations experienced in the heartlands of capitalism... in the 1970s and 1980s are cases in point. If capital does not or cannot move... then overaccumulated capital stands to be devalued directly through the onset of a deflationary recession or depression. (Harvey 2003: 116)

Either way, spatial fixes can be expected to be associated with interregional volatility and the redirection of capital flows from one space to another. The redirection may occur smoothly, or it may involve what Harvey calls "switching crises" (2003: 121-23; 1982: 428-29). Harvey does not spell out the relationship between overaccumulation crises, spatial-temporal fixes, and switching crises. But the drift of his argument seems to be that, while overaccumulation crises are the cause, switching crises are a possible effect of the spatial-temporal fixes that recurrently revolutionize the historical geography of capitalism. They stem from resistance to the relocations involved in spatial fixes–a resistance that at least in part originates from the contradictory logic of capital accumulation itself. Indeed,"the more capitalism develops," argues Harvey, "the more it tends to succumb to the forces making for geographical inertia."

> The circulation of capital is increasingly imprisoned within immobile physical and social infrastructures which are crafted to support certain kinds of production... labor processes, distributional arrangements, consumption patterns, and so on. Increasing quantities of fixed capital... check uninhibited mobility.... Territorial alliances, which often become increasingly powerful and more deeply entrenched, arise.... to conserve privileges already won, to sustain investments already made, to keep a local compromise intact, and to protect itself from the chill winds of spatial competition.... New spatial configurations cannot be

> achieved because regional devaluations are not allowed to run their course. The uneven geographical development of capitalism then assumes a form that is totally inconsistent with sustained accumulation either within the region or on a global scale. (1982: 428-9)

In discussing the spatial fix that in his view is most prominent in the present conjuncture (the emergence of China as the main absorber of surplus capital), Harvey adds a new element to the forces of geographical inertia that may prevent new spatial configurations from being achieved: resistance to hegemonic change. For this "remarkable version" of spatial-temporal fix "has global implications not only for absorbing overaccumulated capital, but also for shifting the balance of economic and political power to China as the regional hegemon and perhaps placing the Asian region, under Chinese leadership, in a much more competitive position vis-a-vis the United States." This possibility makes US resistance to a smooth spatial fix all the more likely, despite the fact that such a fix holds out the best prospect for a solution of the underlying overaccumulation crisis (Harvey 2003: 123-4).

The association between spatial fixes and hegemonic shifts thus strengthens the "catch-22" that always confronts previously leading centers of capitalist development. The unconstrained development of capitalism in new regions brings devaluation to these centers through intensified international competition. Constrained development abroad limits international competition but blocks off opportunities for the profitable investment of surplus capital and so sparks internally generated devaluations (Harvey 1982: 435). If the competitively challenged center is also a hegemonic center, either outcome threatens to deflate not just its assets but its power as well.

Harvey envisages two possible ways out of this catch-22. One is the use of financial means "to rid the system of overaccumulation by the visitation of crises of devaluation upon vulnerable territories" (2003: 134). And the other is the use of political and military means to turn international competition to the advantage of the more powerful states. The deployment of these means constitutes the "sinister and destructive side of spatial-temporal fixes to the overaccumulation problem."

> Like war in relation to diplomacy, finance capital intervention backed by state power frequently amounts to accumulation by other means. An unholy alliance between state powers and the predatory aspects of finance capital forms the cutting edge of a "vulture capitalism" that is as much about cannibalistic practices and forced devaluations as it is about achieving harmonious global development. (2003: 135-6)

Harvey goes on to note that these "other means" are what Karl Marx, following Adam Smith, referred to as the means of "primitive" or "original" accumulation. He quotes approvingly Hannah Arendt's observation that "the emergence of 'superfluous' money... which could no longer find productive investment within the national borders," created a situation in the late 19th and early 20th centuries whereby Marx's "original sin of simple robbery... had eventually to be repeated lest the motor of accumulation suddenly die down" (Harvey 2003: 142). Since a similar situation appears to have emerged again in the late 20th and early 21st centuries, Harvey advocates a "general reevaluation of the continuous role and persistence of the predatory practices of 'primitive' or 'original' accumulation within the long historical geography of capital accumulation." And since he finds it peculiar to call an ongoing process "primitive" or "original," he proposes to replace these terms with the concept of "accumulation by dispossession."

Historically, accumulation by dispossession has taken many different forms, including the conversion of various forms of property rights (common, collective, state, etc.) into exclusive property rights; colonial, semi-colonial, neo-colonial, and imperial appropriations of assets and natural resources; and the suppression of alternatives to the capitalistic use of human and natural resources. Although much has been contingent and haphazard in the *modus operandi* of these processes, finance capital and the credit system have been major levers of dispossession, while the states, with their monopolies of violence and definitions of legality have been crucial protagonists (Harvey 2003: 145-9). But whatever its manifestations, agencies, and instruments,

> What accumulation by dispossession does is to release a set of assets (including labor power) at very low (and in some instances zero) cost. Overaccumulated capital can seize hold of such assets and immediately turn them to profitable use. (Harvey 2003: 149)

Accumulation by dispossession can take place both at home and abroad. The more developed capitalistically a state is, however, the greater the difficulties involved in practicing it at home, and the greater the incentives and the capabilities to practice it abroad. It follows that accumulation by dispossession is only in part a substitute for spatial fixes to overaccumulation crises. To an extent that increases with the development of capitalism in the states or regions facing overaccumulation problems, it involves a spatial fix of its own–a spatial fix, that is, that expands the geographical scope of the system of accumulation through the forcible or fraudulent appropriation of something for nothing, rather than through the exchange of nominally equivalent values.

II. A Conceptual Map of Historical Capitalism

The concepts reviewed in the preceding section can be used, as Harvey does, to interpret current US dispositions to remake the map of the world to suit US interests and values, in comparison with the dispositions that drove the territorial expansion of capitalist states in the late 19th and early 20th century. But they can also be used to interpret the peculiar expansionary tendencies of historical capitalism over a much longer time horizon than that encompassed by Harvey's observations. This much longer horizon stretches as far back in time as we can detect overaccumulation crises that are in key respects comparable to the present one.

As I have argued in *The Long Twentieth Century*, persistent systemwide overaccumulation crises have characterized historical capitalism long before it became a mode of production in the late 18th and early 19th centuries. Taking long periods of "financialization" across political jurisdictions as the most valid and reliable indicator of an underlying overaccumulation crisis, I identified four partly overlapping "systemic cycles of accumulation" of increasing scale and decreasing duration, each consisting of a phase of material expansion–in the course of which capital accumulates primarily through investment in trade and production–and a phase of financial expansion, in the course of which capital accumulates primarily through investment in property titles and other claims on future incomes. Contrary to the reading of some critics, the identification of these cycles does not portray the history of capitalism as "the eternal return of the same," as Michael Hardt and Antonio Negri put it (2000: 239). Rather, they show that, precisely when the "same" (in the form of recurrent system-wide financial expansions)

appears to return, new spatial-temporal fixes, major switching crises, and long periods of accumulation by dispossession have revolutionized the historical geography of capitalism. Integral to these “revolutions” was the emergence of a new leading agency and a new organization of the system of accumulation.

A comparison of these distinct agencies and organizations reveals, not only that they are different, but also that the sequence of these differences describes an evolutionary pattern towards regimes of increasing size, scope and complexity. This evolutionary pattern is summed up in figure 1 (the figure and much of what follows in this section are taken from Arrighi and Silver 2001: 264-68). The first column of the figure focuses on the "containers of power"—as Anthony Giddens (1987) has aptly characterized states—that have housed the "headquarters" of the leading capitalist agencies of the successive regimes: the Republic of Genoa, the United Provinces, the United Kingdom, and the United States.

Leading	**Regime Type/Cycle**		**Costs Internalized**			
Governmental						
Organization	**Extensive**	**Intensive**	**Protection**	**Production**	**Transaction**	**Reproduction**
World-state						
		US	Yes	Yes	Yes	No
	British		Yes	Yes	No	No
Nation-state						
		Dutch	Yes	No	No	No
	Genoese		No	No	No	No
City-state						

Figure 1: Evolutionary Patterns of World Capitalism

Source: Arrighi and Silver (2001: 265)

At the time of the rise and full expansion of the Genoese regime, the Republic of Genoa was a city-state small in size and simple in organization, which contained very little power indeed. Yet, thanks to its far-flung commercial and financial networks the Genoese capitalist class, organized in a cosmopolitan diaspora, could deal on a par with the most powerful territorialist rulers of Europe, and turn the relentless competition for mobile capital among these rulers into a powerful engine for the self-expansion of its own capital. At the time of the rise and full expansion of the Dutch regime of accumulation, the United Provinces was a hybrid kind of organization that combined some of the features of the disappearing city-states with some of the features of the rising nation-states. The greater power of the Dutch state relative to the Genoese enabled the Dutch capitalist class to do what the Genoese had already been doing—turn interstate competition for mobile capital into an engine for the self-expansion of its own capital—but without having to "buy" protection from territorialist states, as the Genoese had done through a relationship of political exchange with Iberian rulers. The Dutch regime, in other words, “internalized” the protection costs that the Genoese had “externalized” (see Figure 1, column 4).

At the time of the rise and full expansion of the British regime of accumulation, the United Kingdom was not only a fully developed nation-state. It was also in the process of conquering a world-encompassing commercial and territorial empire that gave its ruling groups and its capitalist class a command over the world's human and natural resources without parallel or precedent. This command enabled the British capitalist class to do what the Dutch had already been able to do—turn to its own advantage interstate competition for mobile capital and "produce" all the protection required by the

self-expansion of its capital—but without having to rely on foreign and often hostile territorialist organizations for most of the agro-industrial production on which the profitability of its commercial activities rested. If the Dutch regime relative to the Genoese had internalized protection costs, the British regime relative to the Dutch internalized production costs as well (see Figure 1, column 5). As a consequence of this internalization, world capitalism continued to be a mode of accumulation and rule but became also a mode of production.

Finally, at the time of the rise and full expansion of the US regime of accumulation, the US was already something more than a fully developed nation-state. It was a continental military-industrial complex with sufficient power to provide a wide range of subordinate and allied governments with effective protection and to make credible threats of economic strangulation or military annihilation towards unfriendly governments anywhere in the world. Combined with the size, insularity, and natural wealth of its domestic territory, this power enabled the US capitalist class to internalize not just protection and production costs—as the British capitalist class had already done—but transaction costs as well, that is to say, the markets on which the self-expansion of its capital depended (see Figure 1, column 6).

This steady increase in the geographical size and functional scope of successive regimes of capital accumulation on a world scale is somewhat obscured by another feature of the temporal sequence of such regimes. This feature is a double movement, forward and backward at the same time. For each step forward in the process of internalization of costs by a new regime of accumulation has involved a revival of

governmental and business strategies and structures that had been superseded by the preceding regime. Thus, the internalization of protection costs by the Dutch regime in comparison with the Genoese regime occurred through a revival of the strategies and structures of Venetian state monopoly capitalism that the Genoese regime had superseded. Similarly, the internalization of production costs by the British regime in comparison with the Dutch regime occurred through a revival in new and more complex forms of the strategies and structures of Genoese cosmopolitan capitalism and Iberian global territorialism. And the same pattern recurred once again with the rise and full expansion of the US regime, which internalized transaction costs by reviving in new and more complex forms the strategies and structures of Dutch corporate capitalism (see Figure 1, columns 1 & 2).

This recurrent revival of previously superseded strategies and structures of accumulation generates a pendulum-like movement back and forth between "cosmopolitan-imperial" and "corporate-national" organizational structures, the first being typical of "extensive" regimes—as the Genoese-Iberian and the British were—and the second of "intensive" regimes—as the Dutch and the US were. The Genoese-Iberian and British "cosmopolitan-imperial" regimes were extensive in the sense that they have been responsible for most of the geographical expansion of world capitalism. Under the Genoese regime, the world was "discovered," and under the British it was "conquered." The Dutch and the US "corporate-national" regimes, in contrast, were intensive in the sense that they have been responsible for the geographical consolidation rather than expansion of the historical capitalism. Under the Dutch regime, the "discovery" of the world realized primarily by the Iberian partners of the Genoese was consolidated into an

Amsterdam-centered system of commercial entrepots and joint-stock chartered companies. And under the US regime, the "conquest" of the world realized primarily by the British themselves was consolidated into a US-centered system of national states and transnational corporations.

This alternation of extensive and intensive regimes blurs our perception of the underlying, truly long-term, tendency towards the formation of regimes of increasing geographical scope. When the pendulum swings in the direction of extensive regimes, the underlying trend is magnified, and when it swings in the direction of intensive regimes, the underlying trend appears to have been less significant than it really was. Nevertheless, once we control for these swings by comparing the two intensive and the two extensive regimes with one another—the Genoese-Iberian with the British, and the Dutch with the US—the underlying trend becomes unmistakable.

The globalization of historical capitalism has thus been based on the formation of ever more powerful cosmopolitan-imperial (or corporate-national) blocs of governmental and business organizations endowed with the capacity to widen (or deepen) the functional and spatial scope of the system of accumulation. And yet, the more powerful these blocs have become, the shorter the life-cycle of the regimes of accumulation that they have brought into being—the shorter, that is, the time that it has taken for these regimes to emerge out of the overaccumulation crisis of the preceding dominant regime, to become themselves dominant, and to attain their limits as signaled by the beginning of a new - overaccumulation crisis. Relying on Braudel's dating of the beginning of financial expansions, I have calculated that this time was less than half both in the case of the

British regime relative to the Genoese and in the case of the US regime relative to the Dutch (Arrighi 1994: 216-17).

This pattern of capitalist development whereby an increase in the power of regimes of accumulation is associated with a decrease in their duration, calls to mind Marx's contention that "*the real barrier* of capitalist production is *capital itself*" and that capitalist production continually overcomes its immanent barriers "only by means which again place these barriers in its way on a more formidable scale" (1962: 244-5). But the contradiction between the self-expansion of capital on the one side, and the development of the material forces of production and of an appropriate world market on the other, can in fact be reformulated in even more general terms than Marx did. For capitalism as historical social system became a "mode of production"—that is, it internalized production costs—only in its third (British) stage of development. And yet, the principle that the real barrier of capitalist development is capital itself, that the self-expansion of existing capital is in constant tension, and recurrently enters in open contradiction, with the expansion of world trade and production and the creation of an appropriate world market—all this was clearly at work already in the Genoese and Dutch stages of development, notwithstanding the continuing externalization of agro-industrial production by their leading agencies. In all instances the contradiction is that the expansion of trade and production was mere means in endeavors aimed primarily at increasing the value of capital. And yet, over time it tended to generate more capital than could be absorbed profitably within the confines of the extant spatial-temporal fix (in the material meaning of the expression), thereby threatening to drive down overall returns to capital and thus deflate its value.

The resolution of the ensuing overaccumulation crises through a new spatial-temporal fix (in both meanings of the expression) has taken relatively long periods of time–as a rule more than half a century. In all instances, the resolutions have been punctuated by major switching crises and have involved processes typical of accumulation by dispossession. Although much in the *modus operandi* of these processes has indeed been contingent and haphazard as Harvey suggests, in *Chaos and Governance* my co-authors and I have nonetheless detected some regularities, three of which are especially germane to our present concerns.

First, one kind or another of financialization has always been the predominant response to the overaccumulation problem of the established organizing centers of the system of accumulation. Thanks to their continuing centrality in networks of high finance, these centers have been best positioned to turn the intensifying competition for mobile capital to their advantage, and thereby reflate their profits and power at the expense of the rest of the system. Over time, however, financial expansions have promoted the geographical relocation of the centers of capital accumulation by rerouting surplus capital to states and regions capable of ensuring a more secure and profitable spatial-temporal fix to the overaccumulation crisis. Previously dominant centers have thus been faced with the Sisyphean task of containing forces that keep rolling forth with ever renewed strength. Sooner or later, even a small disturbance can tilt (and historically have invariably tilted) the balance in favor of the forces that wittingly or unwittingly are undermining the already precarious stability of existing structures, thereby provoking a breakdown of the system of accumulation (Arrighi and Silver 1999: 258-264).

Second, the states have been key protagonists of the struggles through which old spatial-temporal fixes are destroyed and fixes of greater geographical scope are attained. In the past, switches to fixes of greater geographical scope were premised on the interstitial emergence of governmental-business complexes that were (or could plausibly become) more powerful both militarily and financially than the still dominant governmental-business complex--as the US complex was relative to the British in the early twentieth century, the British complex relative to the Dutch in the early eighteenth century, and the Dutch relative to the Genoese in the late sixteenth century. In the present transition, it is not yet clear whether and how a governmental-business complex more powerful than the US complex can emerge and eventually provide a solution to the ongoing overaccumulation crisis. But in so far as the past dynamic of historical capitalism is concerned, this tendency towards the formation of ever more powerful governmental-business complexes is one of its most important features (Arrighi and Silver 1999: 88-96, 263-70, 275-8, 286-89).

Finally, in each transition accumulation by dispossession has provoked movements of resistance and rebellion by subordinate groups and strata whose established ways of life were coming under attack. Interacting with the interstate power struggle, these movements eventually forced the dominant groups to form new hegemonic social blocs that selectively included previously excluded groups and strata. This increasing “democratization” of historical capitalism has been accompanied by a speedup in the impact of social conflict on overaccumulation crises. Thus, while the overaccumulation crisis of the Dutch regime of accumulation was a long drawn out process in which systemwide social conflict came much later than the systemwide

financial expansion, in the overaccumulation crisis of the British regime the systemwide financial expansion gave rise almost immediately to systemwide social conflict. This speedup in the social history of capitalism has culminated in the explosion of social conflict of the late 1960s and early 1970s, which preceded and thoroughly shaped the crisis of the US regime of accumulation (Arrighi and Silver 1999: 153-216; 282-6; Silver 2003).

III. Toward a Geographical Representation of Historical Capitalism

The foregoing analysis suggests five basic rules that in my view are essential to a minimally accurate geographical representation of the processes that underlie the globalization of historical capitalism over the past half millennium. Having run out of time, I can only list these rules and leave their further specification for the presentation of the paper at the conference.

Rule # 1. The idea still dominant in world-system analysis of a quantitatively expanding but structurally invariant world capitalist systems must be abandoned, including and especially the notion of Kondratieff cycles, hegemonic cycles, and logistics as empirical manifestations of such a structural invariance. The globalization of historical capitalism must instead be represented as involving fundamental structural transformations of the spatial networks in which the system of accumulation has been embedded.

Rule # 2. In this kind of representation, priority should be given to the networks of each regime's leading business and governmental organizations. Due attention should be paid to the fact that the spatial organization of "cosmopolitan-imperial" (extensive) regimes is quite different from that of "corporate-national" (intensive) regimes. Comparisons across time of the degree of globalization attained by historical capitalism must take into account and highlight the most important differences between these two kinds of regime.

Rule # 3. Representaions should focus on those points in time that enable us to highlight not just cyclical but structural transformations as well. Points in time close to the change of phase from material to financial expansion are the most important from both points of view. By comparing a succession of representations at such times, we would highlight structural transformations. And by comparing each of these representations with analogous representations at later points within the life-time of the same regime, we would highlight the cyclical transformations involved in the recurrence of overaccumulation crises.

Rule # 4. Representations of any particular regime of accumulation at a late stage of its development, should depict not just the dominant spatial fix but also the interstitial emergence of agencies and networks that subsequently provided a solution to the underlying overaccumulation crisis. If feasible, we should try to represent also the interstitial emergence of other agencies and networks that never became dominant but constituted plausible historical alternatives to those that did.

Rule # 5. To the extent that social conflicts are included in the representations, account should be taken both of their concentration in periods of accumulation by dispossession, and of their transformation from being a "dependent variable" to being an "independent variable" in relation to overaccumulation crises. In any event, the geographical mapping of social conflict requires concepts and techniques that fall beyond the scope of this paper.

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This paper assesses the achievements and limitations of the commodity chains framework as it has evolved over the last near-decade, and concludes by suggesting directions for future research. First, I examine the evolution of the chain approach by briefly discussing the differences between the two camps that employ the commodity chain concept: the world-systems school (whose proponents coined the phrase) and the global commodity chain (GCC) camp that has developed around the work of Gary Gereffi and colleagues. Second, I highlight the contributions that the GCC literature has made in the areas of methodology, theory, and policy. Third, I discuss a recent change in nomenclature that has occurred within the GCC camp, as some scholars have argued that the more inclusive language of value chains should replace the more specific concept of commodity chain. I offer a critical assessment of the value chain approach, focusing on the concept of industrial upgrading, which figures prominently in the value chains literature. I conclude that while the upgrading problematic is particularly relevant and useful for policy discussions, its micro-orientation focuses our attention too narrowly on the firm or network level, and thus fails to inform a more sociological and comprehensive analysis of the social processes and spatial dynamics of uneven development in the global capitalist economy. In the fourth section, I briefly identify fruitful directions for commodity chains research that might address some of the weaknesses inherent in the value chain literature. Future research should expand the scope of analysis to include the various factors external to the chain, including the regulatory, institutional, and systemic contexts in which they operate, which affect the organization of these chains as well as the developmental outcomes associated with them.

While this next generation of commodity chain research should build on the impressive achievements of the first, the value of the GCC approach can be strengthened by paying greater attention to these factors, and how they mediate the implications of participation in commodity chains for firms and workers in the global economy. This will advance our understanding not only of how commodity chain dynamics might be leveraged to advance the goal of firm-level industrial upgrading, but also how these chains, and the political and social relations in which they are embedded, contribute to the process of uneven development characterizing contemporary global capitalism.

From Commodity Chains to Value Chains and Back Again?

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Abstract
This paper assesses the achievements and limitations of the commodity chains framework as it has evolved over the last near-decade, and concludes by suggesting directions for future research. First, I examine the evolution of the chain approach by briefly discussing the differences between the two camps that employ the commodity chain concept: the world-systems school (whose proponents coined the phrase) and the global commodity chain (GCC) camp that has developed around the work of Gary Gereffi and colleagues. Second, I highlight the contributions that the GCC literature has made in the areas of methodology, theory, and policy. Third, I discuss a recent change in nomenclature that has occurred within the GCC camp, as some scholars have argued that the more inclusive language of value chains should replace the more specific concept of commodity chain. In this section, I evaluate the concept of industrial upgrading, which figures prominently in the value chains literature and conclude that while the upgrading problematic is particularly relevant and useful for policy discussions, its micro-orientation focuses our attention narrowly on the firm level, and thus fails to inform a more sociological and comprehensive analysis of the social processes and spatial dynamics of uneven development in the global economy. In the fourth section, I briefly identify fruitful directions for commodity chains research that might address some of the weaknesses inherent in the value chain literature. Specifically I argue that GCC research should focus on the regulatory, institutional, and systemic factors that shape commodity chains and condition the development outcomes associated with them. In laying out this agenda, I draw on a number of recent contributions which suggest that a second generation of commodity chain research can already be discerned.

Arguably, a general consensus has characterized the field of development studies for more than two decades. The failure of state-led industrialization models in much of the former Third World and the debt crisis of the 1980s, as well as the success of East Asia's export-oriented economies, has been interpreted as evidence that integration into the global economy is the only option for developing countries to pursue.[1] While recent criticisms of the neoliberal paradigm have argued that the state still has a role to play in facilitating development (Amsden 2001; Rodrik 2002), even critics of the market-radical versions of the prevailing orthodoxy nevertheless appear to take as self-evident the proposition that the goal for developing countries is increased competitiveness in world markets. In this context, it is not surprising that the global commodity chains (GCC) framework has inspired and oriented a spate of recent scholarship attempting to incorporate analyses of globalization into development studies.

While many observers have noted the "impasse" or "disarray" plaguing development studies since the neoliberal turn across much of the former Third World (Manzo 1991; Portes 1997; Robinson 2002), the GCC approach has been regarded as something of an exception to this general malaise. British sociologist Jeffrey Henderson contends that the GCC framework "foregrounds in news ways the dialectic of possibility and constraint associated with industrialization in the developing world and industrial transformation elsewhere. In so doing it has the capacity to show empirically the nature of the benefits and limitations on economic and social development that derive from the particular forms which global economic linkage takes" (1996: 405; also Raikes et al 2000).[2] Furthermore, the steady increase in contributions to the GCC

[1] A lively debate continues about the lessons to be drawn from the "East Asian miracle", however. As has been widely noted (Amsden 1994; Wade 1996; Berger and Beeson 1998), the World Bank's well-known assessment of the region's success (1993) relied on a partial reading that emphasized the soundness of the region's macroeconomic fundamentals and downplayed the prevalence of factors, such as industrial policy, that departed from neoliberal orthodoxy.

[2] The GCC framework is not without its critics, however. One might summarize these critics as making two main points. First, the empirical scope of this literature is too narrow, with most studies to date focusing primarily on commodity chains in a relatively small number of manufacturing industries and concentrating almost exclusively on only one of the four chain dimensions specified in the framework, (governance structure) at the expense of the other three (Henderson et al. 2002). Second, GCC research has not

literature in recent years is evidence of the framework's value for researchers interested in the organizational dynamics and developmental outcomes of global industries.

This paper assesses the achievements and limitations of the commodity chains framework as it has evolved over the last near-decade, and concludes by suggesting directions for future research. First, I examine the evolution of the chain approach by briefly discussing the differences between the two camps that employ the commodity chain concept: the world-systems school (whose proponents coined the phrase) and the global commodity chain (GCC) camp that has developed around the work of Gary Gereffi and colleagues. Second, I highlight the contributions that the GCC literature has made in the areas of methodology, theory, and policy. Third, I discuss a change in nomenclature that has occurred within the GCC camp, as some scholars have argued that the more inclusive language of value chains should replace the more specific concept of commodity chain. I argue that the recent elaboration of a global value chain theory suggests a further distancing between the earlier commodity chain literature and its more recent value chain variant. Because the concept of industrial upgrading figures prominently in the value chains literature, I offer a critical assessment of the upgrading construct in this section, concluding that it focuses attention too narrowly on the firm level to inform a more sociological and comprehensive analysis of contemporary development processes. In the fourth and final section, I briefly outline fruitful directions for commodity chains research that can address some of the weaknesses inherent in the value chain literature. Specifically I argue that research should focus on the regulatory, institutional, and systemic factors that shape commodity chains and condition the development outcomes associated with them. In laying out this agenda, I draw on a number of

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adequately considered the salience of the broader institutional contexts in which chains operate (Czaban and Henderon 1998; Whitley 1996), nor has it succeeded in locating these networks within the broader structure of a "hierarchical and stratified global system" (Robinson 2002: 1053; see also, Raikes et al. 2000; Dicken et al. 2001). Relatedly, the state remains undertheorized within this framework, as does politics (including the way in which chains are inflected by class and gender) more generally (Smith et al. 2002; Phyne and Mansilla 2003). It is my hope that the preliminary agenda for a second generation of commodity chain research sketched out in the final section of this paper will help address some of these empirical and theoretical lacunae.

recent contributions which suggest that a second generation of commodity chain research can already be discerned.

I. From commodity chains to GCCs

The term commodity chain appears in the opening pages of Wallerstein's *Historical Capitalism*, in which the author summarizes the distinctiveness of capitalism as a historical social system characterized by the "widespread commodification of processes—not merely exchange processes, but production processes, distribution processes and investment processes—that had previously been conducted other than via a 'market'" (1983: 15). Wallerstein goes on to use the term commodity chain to describe the complex ways in which production processes are "linked to one another" (16). In a 1986 article by Wallerstein and Terrence Hopkins analyzing trade and capital flows in the global economy prior to 1800, a commodity chain is defined with greater precision as a "a network of labor and production processes whose end result is a finished commodity" (159). The term also appears in an article by Giovanni Arrighi and Jessica Drangel in the same 1986 issue of *Review*. In their discussion of the core-periphery distinction in the world-economy, Arrighi and Drangel note that this dichotomy "is meant to designate the unequal distributions of rewards among the various activities that constitute the single overarching division of labor defining and bounding the world economy. All these activities are assumed to be integrated in commodity chains" (16).

In 1994, an edited volume by Gary Gereffi and Miguel Korzeniewicz launched a framework for the study of what they called global commodity chains (GCCs). The chapters appearing in *Commodity Chains and Global Capitalism* (including one by Hopkins and Wallerstein) had been given as papers at the 16th annual conference on the Political Economy of the World-System, which took place at Duke University in April, 1992. Although the intellectual lineage of the GCC concept can thus be traced clearly to its roots in the world-systems literature, it is important to note the disjuncture between the tradition of commodity chain research deriving

from Wallerstein's formulation and what has been developed by Gary Gereffi and colleagues as the GCC paradigm. Below I briefly discuss two examples of this disjuncture, focusing on differences in opinion between the two camps regarding the nature of globalization and the objective of commodity chain analysis.

Research on commodity chains from a world-systems perspective has focused on the historical reconstruction of the shipping and wheat flour industries during the long sixteenth century, whereas scholars identifying with the GCC approach have taken a sectoral approach to analyzing the inter-organizational dynamics of global industries in today's international economy. The difference in temporal orientation, between the historical approach of the world-systems camp on the one hand and the more contemporary flavor of GCC research on the other, reflects a disagreement between the two schools regarding the novelty and salience of "globalization." World-systems scholars contend that "transstate, geographically extensive, commodity chains are *not* a recent phenomenon, dating from say the 1970s or even 1945,…they have been an integral part…of the functioning of the capitalist world-economy since it came into existence in the long sixteenth century" (Wallerstein 2000: 2). In contrast, the latter group views global commodity chains as an emergent organizational form associated with a more recent and qualitatively novel process of economic integration: "One of the central contentions of the GCC approach is that the internationalization of production is becoming increasingly integrated in globalized coordination systems that can be characterized as producer-driven and buyer-driven commodity chains" (Gereffi 1996: 429).[3]

For Gereffi and colleagues, the ascendancy of globalization demands new methods for studying a country's prospects for mobility in the international economy. They argue that the state-centered approaches that have traditionally dominated the study of development fail to

[3] I am grateful to Phil McMichael for pointing out that although the world-systems camp uses the term commodity chains without the "global" modifier, this omission does not suggest a less geographically expansive understanding of the construct. In fact, it suggests just the opposite—its conviction that such chains have been global in scope since the long sixteenth century.

recognize the increasingly significant ways a country's economic performance is affected by participation in integrated internationalized production systems: "Our GCC framework allows us to pose questions about contemporary development issues that are not easily handled by previous paradigms, and permits us to more adequately forge the macro-micro links between processes that are generally assumed to be discreetly contained within global, national, and local units of analysis" (Gereffi, Korzeniewicz, and Korzeniewicz 1994: 2). The principal task of GCC analysis is to explicate the organizational dynamics of global industries in order to understand where, how, and by whom value is created and distributed (Appelbaum and Gereffi 1994). Special attention is paid to the most powerful or "lead firms" in a sector, which are also known as "chain drivers," because of their presumed importance as potential agents of upgrading and development: "One of the major hypotheses of the global commodity chains approach is that development requires linking up with the most significant lead firms in the industry" (Gereffi 2001: 1622).

GCC researchers claim that this approach allows one to look at how a country's developmental prospects are shaped by its participation in international production networks understood as global commodity chains. Its substantive interest in, and analytical emphasis on, national development represents a further break between the GCC framework and the world-systems tradition, as one of the latter's main contentions is that national development is a meaningless concept in a stratified global capitalist economy premised on the exploitation of the periphery and semi-periphery by the wealthy countries of the system's core (Arrighi and Drangel 1986; Wallerstein 1974, 1994). While one may observe minimal mobility between these levels, as individual countries move up or down, what is relevant from the perspective of world-systems theory is the reproduction of this hierarchically structured global capitalist economy.

As Wallerstein has explained because "there is no such thing as 'national development'…the proper entity of comparison" or unit of analysis is the world-system (Wallerstein 1974), not the individual countries that make up the collective whole, and surely less the networks of particular firms that are the primary object of GCC inquiry. Thus, world-systems

researchers are interested in the entirety of commodity chains, not their constituent parts. Whereas much of the GCC literature to date is devoted to describing the characteristics of different links of the chain, as well as the relations between them, the world-systems camp contends that it "is the characteristics of the chain as a whole that should be the primary object of investigation, not those of particular boxes, or particular aspects of all boxes" (Wallerstein 2000: 12).

These differences manifest distinct research agendas. World-systems scholars consider the commodity chain "a vital research location" for the study of the capitalist world economy (Wallerstein 2000: 199). For them, the chain construct is useful insofar as it illuminates the dynamics of capital accumulation at a particular point in the evolution of the world-system, and thus one of the major objectives of world-systems research on commodity chains is to develop ways of calculating the total surplus value of a chain and tracing the distribution of that surplus between the various links (or boxes, in Wallerstein's terminology) that comprise it.[4] Identifying different rates of return across the boxes of a particular chain can shed light on the "pattern of complex and shifting investments among different sectors of the economy…, and why being in the industrial sector was not and is not always the most interesting place to be in terms of capital accumulation" (ibid: 7).

Although most reviews of the GCC literature locate its intellectual origins in the world-systems orientation (Dicken et al. 2001; Smith et al. 2002; Phyne and Mansilla 2003) or identify its roots in "radical development theory" (Whitley 1996: 404) or "the dependency tradition of analysis" (Henderson et al. 2002), the GCC camp has moved research on commodity chains away from the type of long-range historical and macro-level analysis typical of the world-systems

[4] Drawing on the work of David Harvey (1982), Smith et al. use a similar language in talking about commodity chains in their recent discussion of macro-regional integration: "Chains of commodity production and selling thus become mechanisms to enable increases in productivity, reductions in the value of labour power and reductions of the turnover time of capital to enhance the extraction of *surplus value*" (2002: 52).

school. Rather, the GCC framework has evolved as a network-based, organizational approach to studying the sectoral dynamics of global industries (Raikes et al. 2000).[5]

One of the main strengths of the GCC framework is that the clear research agenda that proceeds from it has engendered a coherent body of empirical research on global industries. Since the mid-1990s, an international community of scholars has studied a wide variety of commodity chains that range across Asia, Africa, and Latin America, as well as North America and Europe. Among the industries included in this research are tourism, apparel and textiles, footwear, automobiles, electronics, plastics, and a variety of agricultural commodities including fruits, vegetables, coffee and cocoa.[6] While this article will not attempt a comprehensive review of the existing literature oriented by the GCC framework, the next section offers reflections on this past near-decade of research.

II. What have we learned from research on global commodity chains?

In the ten years since the publication of Gereffi and Korzeniewicz's edited volume, *Commodity Chains and Global Capitalism*, a substantial body of work on GCCs has accumulated. It is already possible to identify three significant contributions of this literature in the areas of methodology, theory, and policy-making. First, the development and application of the global commodity chains framework is a *methodological* advance because it provides a way to map and analyze the spatially dispersed and organizationally complex production networks that are an important part of economic globalization. It departs from much of the research in the

[5] As Andrew Schrank has noted, the disjuncture between the world-systems and GCC schools was evident as early as 1995, in a review of *Commodity Chains and Global Capitalism* by Wilma Dunaway and Donald Clelland in the *Journal of World-Systems Research*. They criticize the volume for its developmentalist tone, lamenting that "[w]hat never appears in this book is the key idea that lies at the heart of understanding the international division of labor: unequal exchange. There is little or no attention to the central world-system thesis that exploitation and domination are structured at multiple levels of the commodity chains that are so painstakingly depicted." Cf. McMichael 1995. See also the reply by Korzeniewicz, Gereffi, and Korzeniewicz in the subsequent volume (vol. 2) of the *Journal of World-Systems Research*.

[6] A sample of this literature which gives some indication of the range of industries studied include Bair and Gereffi 2002; Clancy 1998; Fitter and Kaplinsky 2001; Fold 2002; Gibbon 2001; Ponte 2002; Rabach and Kim 1994.

world-systems tradition, in this regard, as the macro-orientation of the latter tends to efface difference within macro-regions, let alone the increasing diversity that exists within national economies, as export-oriented policies promote uneven development trajectories that reinforce existing inequalities within, as well as across, countries. Insofar as GCC research analyzes the activities of particular firms, and especially the chain drivers that play the pivotal role in organizing international production networks, it gives greater weight than a more orthodox world-systems approach would to the role of firms as agents in the global economy.

Second, research on GCCs has contributed at the *theoretical* level to our understanding of the inter-organizational dynamics of contemporary capitalism and, in particular, how power is exercised in global industries. Further elaboration of this point calls for a brief review of the GCC framework. Gereffi identifies four dimensions with respect to which every commodity chain can be analyzed: 1) an input-output structure (the process of transforming raw materials into final products), 2) a territoriality (or geographical scope), 3) a governance structure, and 4) institutional context.[7] As has been noted (Raikes et al. 2000; Henderson et al. 2002), studies of existing GCCs have focused primarily on the governance dimension—that is, the question of which firms in the chain are most able to control various aspects of the production process and how they appropriate and/or distribute the value that is created.

The concept of governance as it is understood in the GCC framework, and as it has been examined in numerous case studies of particular commodity chains, recognizes what much of the literature on flexible specialization or post-fordism has documented—namely, that in the contemporary international economy, dynamics of power and control are not necessarily

[7] In his original elaboration of the GCC framework, Gereffi (1994) identified only the first three dimensions. Institutional context was added later (Gereffi 1995), and remains the least developed dimension. While it is true that the other dimensions of commodity chains have received less empirical attention and thus remain theoretically underdeveloped, the emphasis in the GCC literature on governance stems from Gereffi's interest in how globalization enables new forms of coordination and management, which in turn affect the composition, organization and geography of economic (and particularly industrial) activities. In this way, the development of the governance aspect of global commodity chains has laid the foundation for more detailed investigations of the other dimensions of GCCs that the framework identifies.

correlated with traditional patterns of ownership. The empirical insights afforded by research on the governance dimension of GCCs have helped flush out the meaning of the interfirm network as an organizational form that is neither market nor hierarchy (though it may exhibit characteristics of each).

Perhaps the best known distinction in the GCC literature is the one Gereffi draws between producer-driven (PDCC) and buyer-driven commodity chains (BDCC). The former are characteristic of more capital-intensive industries (e.g. motor vehicles) in which powerful manufacturers control and often own several tiers of vertically-organized suppliers, as opposed to light manufacturing industries (apparel being the classic case), where far-flung subcontracting networks are managed by designers, retailers, and other brand-name firms that market, but do not necessarily make, the products that are sold under their label (Gereffi 2001).

While the applicability and utility of the PDCC/BDCC distinction has been disputed (Clancy 1998, Gellert 2003, Henderson et al. 2002), what is most significant about the dichotomy between these ideal types is the theorization of commercial capital (what are often called "big buyers" in the GCC literature) as the power brokers that call the shots for the many firms involved in the buyer-driven commodity chains they control, although they may have little relation to the actual production of goods made on their behalf.[8] While the apparel industry is the best documented case of a buyer-driven commodity chain (Gereffi 1999), a similar governance structure has been identified in the commodity chain for some agricultural products, in this latter case reflecting the increasing power of supermarkets as the relevant big buyer (Dolan and Humphrey 2000). The implications of this finding are particularly salient since the widespread disavowal of import-substituting industrialization strategies in the global South in favor of export-

[8] In their recent discussion of the GCC framework, Henderson et al. criticize this dichotomy between the two types of governance structures, concluding that because the PDCC-BDCC "distinction is intended to refer to sectorally and organizationally specific empirical realities," it is not "an ideal-typical construction." However, this reading is inconsistent with descriptions of the governance forms found in the GCC literature (cf. Gereffi 1994: 96-99).

oriented initiatives that frequently encourage specialization in the kind of labour-intensive, light manufacturing industries characterized by buyer-driven commodity chains.

Third, I want to briefly highlight the *policy implications* of GCC research. As will be discussed in greater detail in the next section, recent work from the so-called value chains perspective, which is related to the GCC framework, has focused on finding ways to leverage the insights afforded by the latter into effective policy interventions that can enable local firms to improve their positions in particular value chains—a process the value chain literature identifies as upgrading: "Understanding how…value chains operate is very important for developing-country firms and policy-makers because the way chains are structured has implications for newcomers. How can economic actors gain access to the skills, competencies and supporting services required to participate in global value chains? What potential is there for firms, industries, and societies from the developing world to 'upgrade' by actively changing the way they are linked to global value chains?" (Gereffi et al. 2001: 2). Local and national governments, as well as international institutions such as the International Labour Organization, have expressed interest in the answers to these questions, viewing the GCC framework as a paradigm that can usefully orient and inform policy (Henderson et al. 2002; Gereffi 2004, forthcoming).

There is another way in which GCC research is being applied in the strategies of a very different constituency—NGOs, such as anti-sweatshop groups that promote "clean clothes" campaigns and organizations supporting other forms of consumer "activism" such as fair trade coffee (Gereffi, Garcia-Johnson and Sasser, 2001).[9] Since the mid-1990s, following several well-publicized cases of labor abuses in U.S., Latin American, and Asian garment factories producing for well-known brand-names such as The Gap, student and consumer groups across North America and Europe have focused on the problem of how to promote labor rights, safe working

[9] For a particularly clear example of this influence, see the 2003 publication "Tehuacan: blue jeans, blue waters, and workers rights" by the Maquila Solidarity Network, which employs a general commodity chain orientation, and also draws substantially and fruitfully (though not uncritically) on GCC studies (particularly Bair and Gereffi 2001).

conditions, and a living wage in global industries dominated by powerful and footloose big buyers on the one hand, and characterized by a workforce that is powerless and largely invisible to the consumer on the other. One significant thrust of this effort has been to create accountability in global industries by identifying the relationships between lead firms and their suppliers and subcontractors around the world, and demanding that the former enforce codes of conduct designed to insure that their products are made in a sweat-free environment. This methodology requires tracing the interfirm networks that a GCC orientation allows one to identify and such "real world" applications of the commodity chains concept are among the most fruitful implications of this research to date.

Despite these achievements, in the remainder of this paper, I argue that important work on commodity chains remains to be done. In the next section, I describe the emerging "global value chains" literature and assess its relationship to the global commodity chain construct. In so doing, I hope to highlight the limitations of this paradigm, and in particular the emphasis that the value chains literature places on firm-level upgrading.

II. From GCCs to value chains?

As is well known, over the course of the 1980s and 1990s an ever growing number of countries in the developing world shifted from import-substituting industrialization strategies to an export-oriented model, which has been promoted by the international financial institutions and the U.S. Treasury Department as one element in a package of reforms consisting of trade liberalization, macroeconomic stabilization, privatization of state-owned enterprises, and financial market deregulation. Not surprisingly, in this context paradigms that shed light on the workings of international trade and production networks have been in high demand. Because the global commodity chain framework seemed particularly well-suited to inform policy debates about the best way for developing countries to access, and benefit from their participation in,

foreign markets,[10] it was featured prominently in an International Labour Office research program on globalization and employment in the mid-1990s and has influenced the "cluster strategy" being promoted by the United Nations Economic Commission for Latin America and the Caribbean. These initiatives, as well as the general proliferation in recent years of studies on GCCs and how developing-country producers become incorporated into them, attests to the framework's perceived potential for contributing to the study of globalization.

The GCC paradigm is not alone in this regard, however. In fact, the global commodity chains framework is one of several network- or chain-based approaches to the study of economic globalization popular today. Other constructs that have oriented research programs include international production networks (Borrus, Ernst and Haggard 2000), global production networks, (Ernst 1999; Henderson et al. 2002), global production systems (Milberg 2003), and the French filière concept (Jessop 2000; Raikes et al. 2001). Given this variety of approaches, some have argued that it would be useful to agree upon a common terminology of "value chain analysis" as a way of promoting a research community comprised of scholars studying production networks in the global economy. In fact, such a community already exists in the form of a "global value chain" research network (see www.globalvaluechain.org).

The GCC framework has been identified as one of several network methodologies included within the overarching value chain rubric. In a recent review of the value chain literature that endorses the new terminology, Gereffi et al. explain that "the value-chain concept was adopted over several widely-used alternatives because it was perceived as being the most inclusive of the full range of possible chain activities and end products," although the authors

[10] In this context, it is worth noting a certain elective affinity between neoliberal conceptions of development (i.e. growth via market-driven global integration as opposed to state-led strategies) and the global value chain approach which examines the "possibilities for firms in developing countries to enhance their position in global markets" (Gereffi et. al 2004).

note that "each of the contending concepts…has particular emphases that are important to recognize for a chain analysis of the global economy" (Gereffi et al. 2001).[11]

The special issue of the journal *IDS Bulletin* in which the common value-chain terminology is proposed documents the contributions of value chains research in recent years. This July 2001 issue, entitled "The Value of Value Chains: Spreading the Gains from Globalization," represents the first attempt to review and compare the findings of different studies on value chains, as part of a larger effort to "develop common parameters for defining different types of value chains and a taxonomy of value chains that can be operationalised through a robust set of indicators" (Gereffi et al 2001: 3). Synthesizing existing research on value chains allows one to identify similarities in the structure and governance of chains across industries. For example, value chains researchers have noted the rise of a particular type of subcontracting network whereby highly competent suppliers assume responsibility for a full range of activities beyond "basic" production (such as design and inventory/logistics management). Although the terminology varies between industries (from turn-key supply in the electronics industry to full-package supply in the apparel industry), a common value chain orientation makes it possible to identify a similar organizational form across sectors (Sturgeon 2001). Thus, as the editors of the special issue on value chains make clear, establishing a shared language among researchers on global industries allows one to recognize analogous developments across distinct sectors that may be obscured by nominal differences in terminology.

However, should one interpret the shift in language from "commodity chain" to "value chain" as more than a matter of mere nomenclature? A recent paper by Gary Gereffi, John Humphrey, and Timothy Sturgeon (2004), in which the authors attempt to develop a theory of value chain governance, suggest that this is the case. In this article, the authors develop a typology of five types of governance structures that describe the network relationships linking

[11] These distinct emphases may be ignored by other observers who take the "contending concepts" as synonymous or interchangeable. For example, Ponte 2002 refers to "global commodity chain analysis (also known as 'value chain analysis')": 1099.

suppliers in global industries to lead firms. This typology is based on the possible combinations resulting from variations (measured as "low" or "high") in three independent variables: the complexity of transactions, the codifiability of information, and the capability of suppliers. The value chain theory of governance suggests that the relationships between lead firms and suppliers differ across sectors, due to the particular characteristics of the production process and the organization of the industry, such as the sophistication and availability of the technology involved, the existence or absence of (technical and process) standards, and the extent to which rapid turnaround time or speed to market is essential to competitiveness.[12] The goal is to explain variation across sectors in terms of how global production is organized and managed, focusing on the key role of transaction costs, including so-called "mundane" transaction costs that arise from coordinating activities along the chain (Baldwin and Clark 2000).[13]

Although the earlier discussion of the value chain framework referred to above (in the 2001 special issue of *IDS Bulletin*) specifically noted the close relationship between the global commodity chain and value chain concepts, Gereffi, Humphrey, and Sturgeon describe the intellectual influences shaping their project differently in this more recent contribution: "For us, the starting point for understanding the changing nature of international trade and industrial organization is contained in the notion of a value-added chain, as developed by international business scholars who have focused on the strategies of both firms and countries in the global economy." Indeed the only reference to the global commodity chains literature that appears in the 2004 paper notes that, while the GCC framework "drew attention to the role of networks in driving the co-evolution of cross-border industrial organization," it "did not adequately specify

[12] Although the authors acknowledge that local, national, and international "institutions and structures matter," they conclude that "the variables internal to our model influence the shape and governance of global value chains in important ways, regardless of the institutional context within which they are situated." Thus while they acknowledge the importance of institutional and regulatory factors, the authors specifically bracket them as external to their explanatory framework.

[13] While both the GCC and GVC frameworks take the organizational field of the industry as their analytical domain, the latter appears to make stronger claims about the sectoral logics of value chains at the industry-level to explain variation *across* industries, whereas the research in the GCC tradition looks to the different business strategies of lead firms as a way to explain variation in commodity chain organization *within* an industry.

the variety of network forms that more recent field research has uncovered."[14] Gereffi, Humphrey, and Sturgeon attempt to address this weakness by developing a theory of value chain governance that not only acknowledges this variation, but attempts to *explain* it by identifying its key determinants. In so doing they provide an agenda for further value chain research, which will include developing ways to operationalize and measure the key independent variables, and eventually formulating and testing hypotheses derived from the theory of value chain governance.

However, one can also identify an important continuity between the earlier and later elaborations of the value chains framework—an interest in firm-level industrial upgrading. Specifically, the central question of interest for value chain researchers is how firms can improve their position within these chains so as to generate and retain more value. In order to achieve this objective, firms need to understand where they fit into the value chains in which they participate. It is here that the insights generated by GCC research on governance are most useful for value chain analysis, and most specifically, as Gereffi argues in his contribution to the *IDS Bulletin* on value chains, the role of lead firms: "The emergence of new forms of value-chain governance is driven by the evolution of organisational capabilities by leading firms in the global economy…In order for countries to succeed in today's international economy, they need to position themselves strategically within…global networks and develop strategies for gaining access to the lead firms in order to improve their position" (2001b: 32).[15] Similarly, in their 2004 *RIPE* article, Gereffi, Humphrey and Sturgeon express their hope that "the theory of global value chain governance that

[14] In his recent contribution to the new edition of the *Handbook of Economic Sociology*, Gereffi places greater emphasis on the similarities between GCC and GVC analysis, noting that the shift to the latter language was essentially a tactical decision designed to avoid two problems with the earlier vocabulary. *Value* chain is preferred to *commodity* chain because it "focuses on value creation and value capture across the full range of possible chain activities and products (goods and services), and because it avoids the limiting connotations of the word 'commodity'" (2004 forthcoming, 18).

[15] Here Gereffi basically restates his earlier hypothesis that "development requires linking up with the most significant lead firms in the industry" (see p. 4 above). One way to translate this formulation into a testable hypothesis is that, among a population of firms, we expect that those with the strongest relationship to the lead firm will have the best development outcome (however defined). In order to test this hypothesis, we would want a research design that includes firms that are connected to the dominant player in the chain as well as those that are not. If we omit the latter from our sample, we are essentially sampling on the dependent variable, and cannot reliably conclude that the lead firm connection is a necessary, let alone sufficient, condition for development.

we develop here will be useful for the crafting of effective policy tools related to industrial upgrading, economic development, employment creation, and poverty alleviation."

At the most basic level, the value chains literature defines upgrading as improving a firm's position within the chain, and this is generally associated with securing more of the value-added through the production process. But how is this objective achieved, and how are upgrading efforts evaluated? One possible avenue for upgrading that value chains research has identified is for a firm to move up the same value chain from a more marginal to more secure position by increasing the range of functions performed. For example, a turn-key or full-package manufacturer is often responsible for additional functions beyond basic production, such as design or logistics management; this is called intra-chain or functional upgrading. Additional types of upgrading include product upgrading (producing more sophisticated goods with higher unit prices) and process upgrading (improving technology and/or production systems). Inter-chain upgrading (moving from one industry to another) is a fourth type of upgrading that has been identified (Gereffi et al 2001; Humphrey and Schmitz 2000).

As studies of various value chains suggest, firms attempting to upgrade via one of these paths often have considerable difficulty in doing so. In large part, this is due to the increasing barriers to entry that exist as one moves along the chain. Central to the power of lead firms, and particularly those that control buyer-driven chains, are activities related to marketing, design, and brand development. Value chain research tells us that firms can upgrade by capturing more of the value created in these links, while also underscoring the significant, and some would argue increasing, obstacles that they face: "As 'intangible' aspects of production (i.e. marketing, brand development, design) become increasingly important for the profitability and power of lead firms, 'tangibles' [production and manufacturing] have become increasingly commodified, leading to new divisions of labor and new hurdles for developing-country producers to overcome if they wish to enter these chains. It is almost certainly a pervasive trend…that the barriers to entry in intangibles are growing faster than those in tangible activities" (Gereffi et al. 2001). Chains

research of both the GCC and value chain variety have documented the efforts of firms in various industries to upgrade through one or more of these strategies, documenting their successes as well as their failures (Talbot 1997; Bair and Gereffi 2001; Fitter and Kaplinsky 2001). The result of these efforts is a significant contribution to our understanding of the relationship between chain governance and firm-level upgrading prospects, which is, in turn, "critical to the debate on whether there is a spreading of the gains from globalization (Humphrey and Schmitz 2001: 21).

The contribution of value chains research to the debate about globalization's winners and losers should be obvious from the discussion above. However, there are two distinct, though related limitations with the extant formulation of upgrading that the value chains literature offers. First, value chain research focuses on upgrading primarily at the level of the *individual* firm in the context of a *particular* value chain. As noted earlier, when analyzed in comparative perspective, this approach yields evidence of similar organizational forms characterizing global production networks across different industries (such as the rise of turn-key contract manufacturing in the apparel, auto, and electronics industries, as well as some agro-commodities such as cocoa and coffee). As one value chain scholar has noted, recognizing these similarities requires one to look closely at the micro level in order to identify "the specific bundles of activities that firms are engaged in" (Sturgeon 2001: 15).

However, this firm-level orientation poses a unit of analysis dilemma. How does one translate the process of upgrading at the level of the firm into its implications for the larger units that are traditionally regarded as the spaces or containers of development, such as the local, national, or regional economy? Put differently, how do we aggregate up and out from the firm level? While Gereffi has argued that a country's development prospects are conditioned by how they are incorporated into global industries (1995), how does the nature of a *firm's* insertion into a particular commodity chain map on to a *country's* incorporation into the global economy?[16] The

[16] The Gereffi, Humphrey, and Sturgeon article (2004) contains a similar slippage between the industry, firm and country levels of analysis: "The evolution of global-scale industrial organization affects not only

problem is particularly vexing since, just as virtually every nation is linked to the global economy via more than one export role (Gereffi and Wyman 1990), so too are many firms connected to commodity chains via more than one type of linkage (i.e. as a subcontractor for some clients, a full-package supplier for others, and as a producer of own-brand products for the domestic market).

Second, we need to be more careful in specifying *who* the process of upgrading benefits. For example, what is identified as functional or intra-chain upgrading often describes situations in which suppliers take on additional responsibilities (such as design, logistics management, or distruibution) at the behest of the lead firm. While these suppliers in the commodity chain thereby "add value" from the vantage point of the chain driver, another way to interpret this process is the off-loading of less profitable activities onto more vulnerable firms.[17] The ability of a supplier to add greater value to the lead firm may increase its competitiveness vis-à-vis its rivals (until they develop analogous capabilities), but a number of studies suggest that firms which "succeed" in intra-chain or process upgrading do not necessarily reap the rewards, including increased security and profitability, with which upgrading is ostensibly associated (Bair 2002; Fitter and Kaplinsky 2001; Gibbon 2001; Schrank 2002; Schurman 2001).

Research on the changing position of firms within value chains further suggests that upgrading is often a process of exclusion, particularly in developing countries whose integration into the global economy is recent (Gibbon 2001; Dolan and Humphrey 2000). A comparative study of Kenyan horticulture and Indian textile value chains lead Dolan and Tewari to conclude

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the fortunes of firms and the structure of industries, but also how and why countries advance—or fail to advance—in the global economy."

[17] This outcome was identified in the 1986 article by Arrighi and Drangel. Arrighi and Drangel argue that firms within commodity chains are constantly struggling to insulate themselves from competitive pressures by transferring less profitable activities on to other participants: "…economic actors (irrespective of whether they seek a remuneration for labor-power, assets, or entrepreneurial energies), far from accepting competition as a datum, continuously endeavor to shift, and some succeed in shifting, the pressure of competition from themselves onto other actors. As a result, the nodes or economic activities of each and every commodity chain tend to become polarized into positions from which the pressure of competition has been transferred elsewhere (core-like activities) and positions to which such pressure has been transferred (peripheral activities).": 17

that, although a number of local firms in each sector had been able to upgrade successfully, changes in both value chains associated with process upgrading on the part of the largest firms severely circumscribes the future upgrading prospects of smaller producers and poses the "danger of excluding a large swathe of low-performing domestic firms from the circles where new skills and learning are being generated" (2001: 101).

Finally, more careful specification of who benefits from the process of upgrading requires closer attention to the role of workers as chain participants. As we know from a vast and growing literature, firms that successfully participate in global value chains may not deliver benefits to workers in the form of higher wages, greater job security, or improved working conditions (Bair 2002; Ponte 2002; Talbot 1997; Wood 2001). Paying more serious attention to labor than it has been given to date is necessary to fulfill what the proponents of value-chain analysis suggest is one of its primary objectives: to map the distributional incomes resulting from participation in international production networks (Fitter and Kaplinsky 2001). However, beyond looking at the extent to which workers benefit from processes of upgrading in terms of how value is *distributed* along the chain, discussions of upgrading also need to examine how workers contribute to the *creation* of value in terms of the labor process (Smith et al. 2002; cf. Bair and Ramsay 2001).

While the upgrading construct is attractive as a heuristic for talking about mobility along the value chain, it is too narrow a concept to answer the range of questions the value chain perspective claims to address regarding "the winners and losers in the globalisation process, how and why the gains from globalisation are spread, and how the numbers of gainers can be increased" (Gereffi et al. 2001: 2). The framework's proponents recognize "the numerous downsides to globalisation, including falling prices for producers and cases where upgrading of products or processes does not necessarily lead to increased profits and sustainable incomes" (ibid), but in order to understand these downsides we need to expand the scope of inquiry beyond the level of the firm, the value chain, or even the sector. In the fourth and final section of this

paper, I outline several ways in which commodity chains research might be advanced through a discussion of existing literature that suggests a second generation of GCC research is already evolving.

IV. Beyond value chains: A research agenda for the second generation of GCC research

The next generation of GCC research should focus on complementing the paradigm's existing strength as a framework that allows us to conceptualize and study global capitalism as it is manifest in particular inter-firm networks that link economic actors across space. As noted above, the most significant theoretical progress claimed by the first generation of GCC research is a much better understanding of the governance structure of commodity chains in terms of the power exercised by lead firms, and the implications of a chain's governance structure for the upgrading prospects of actors in the chain. While the sectoral logics and interorganizational dynamics of these networks across different industries are increasingly clear, what we need to study more closely are the factors *external* to chains that shape their geography and configuration, and may strongly affect the extent to which different actors benefit from participation in them.[18] There are three sets of such factors that I will briefly discuss below: regulatory, institutional, and systemic.

Regulatory factors, particularly trade policy, shape the geography and configuration of many commodity chains in the global economy. The regulatory context in which international production networks are established and operate is an important element affecting the extent to which developing country exporters in particular benefit from their participation in commodity chains. For example, while Gereffi, Humphrey and Sturgeon emphasize the modular governance structure of the fresh vegetable value chain in explaining the relationship between African exporters and British importers (2004: 12-13), Chris Stevens argues that "the past success

[18] By factors "external" to the chain, I mean to differentiate these from the sectoral characteristics privileged in the existing value chains theory, which refer to the micro linkages of production processes and transaction costs along the chain.

of…African horticultural producers may not be *only* the consequences of having met the demanding technical standards of the UK supermarkets that are the dominant force in the buyer-driven value chain…Meeting technical requirements may be a necessary but not sufficient condition. Trade analysis suggests that past European Union (EU) trade policy has effectively excluded many of the most important global suppliers from the UK market" (2001: 46). Stevens' analysis of the EU market for agricultural products shows that trade policy rents in this sector influence the value chains linking suppliers to European markets, and concludes that this is likely to remain the case in the future, despite the halting trend towards liberalization under the WTO and the reforms of the EU's Common Agricultural Policy.

Stefano Ponte's study of the coffee chain similarly underscores the importance of regulatory factors, in this case the existence and then demise of the international coffee agreements (ICA) which governed trade in this commodity and which influenced the distribution of profits along the coffee chain. Ponte documents how changes in the ICA regime have negatively affected developing country exporters: "From a balanced contest between producing and consuming countries within the politics of international coffee agreements, power relations shifted to the advantage of transnational corporations. A relatively stable institutional environment where proportions of generated income were fairly distributed between producing and consuming countries turned into one that is more informal, unstable, and unequal" (2002: 1099; also Talbot 1997).

Jennifer Bair and Gary Gereffi's research on the North American apparel commodity chain suggests how changes in regulatory context can reshape global commodity chains. They have shown that the dramatic increase in apparel exports from Mexico after 1994 reflected the response of leading U.S. textile and clothing companies to the new trade regime of the North American Free Trade Agreement (NAFTA) (Gereffi 1997; Gereffi and Bair 1998).[19] Lead firms

[19] The research also drew on earlier work analyzing the dynamics of the apparel commodity chain and its relevance for upgrading and development trajectories in East Asia (Appelbaum and Gereffi 1994).

controlling the apparel commodity chain reconfigured their international sourcing and production networks to take advantage of NAFTA's new rules of origin affecting trade in textile products in North America. The initial post-NAFTA boom in apparel exports from Mexico and, to a lesser extent, the expansion of local textile production signaled the rise of "full-package production" in Mexico, as U.S. buyers sought to decrease their dependence on Asian manufacturers in favor of near-by producers south of the border whose fabrics and garments receive preferential access to the U.S. market (Bair and Gereffi 2002).[20]

Bair and Gereffi's research on the North American textile-apparel complex further underscore the importance of *institutional context* as a factor affecting rather (or which) firms and workers benefit from their participation in commodity chains. Having identified the emergence of full-package networks as a post-NAFTA organizational form linking Mexican exporters and U.S. buyers, Bair and Gereffi analyzed data from fieldwork conducted in Mexico in order to see if the process of industrial upgrading at the firm level that they identified (as implied by the shift from the maquila to full-package model) generated positive development outcomes in the various production centers that are home to Mexico's garment exporters (Bair 2001; Bair and Gereffi 2001). As the most recent addition to this body of work has emphasized, the spatial unevenness of Mexico's export boom, and the devastating implications of the U.S. economic downturn for Mexican exporters, underscore the precariousness and contingency of the positive developmental outcomes this export dynamism generated (Bair and Gereffi 2003).

In the apparel industry, as well as in Mexico's other leading export industries, the institutional environment of Mexico's contemporary political economy is of great relevance when evaluating the extent to which capital and labor have benefited from their participation in post-

[20] However, Mexico's competitive position in the U.S. apparel market has been substantially eroded by China's entrance into the World Trade Organization and the continuing phase-in of the Agreement on Textiles and Clothing (ATC). Patterns of trade in the global apparel industry today continue to reflect the regulatory legacy of the Multifibre Arrangement, and therefore widespread reconfiguration of apparel commodity chains is expected when all remaining quotas on textile products are lifted in 2005. See Begg et al 2003 for a comparable discussion of how changes in the trade regime affected the organization of apparel production in East-Central Europe.

NAFTA commodity chains. Nancy Plankey Videla's case study of a large Mexican apparel firm yields complementary findings, which demonstrate the various factors that constrain the upgrading efforts of developing country firms. The company that is the subject of her study, "Moctezuma," successfully upgraded in the sense that it adopted "organizational, technological, and product innovations with the objective of capturing higher value-added activities" (2003: 1).[21] However, Plankey Videla concludes that the firm's inability to translate this process into a foundation for sustainable competitiveness capable of generating benefits for the firm's owners and workers has as much to do with the pressures characteristic of Mexico's contemporary business environment (and particularly a banking system that fails to make adequate amounts if affordable credit available to domestic firms)as with the organizational dynamics of the particular commodity chains in which this firm was participating.[22]

The importance of the institutional and political-economic context in which global commodity chains "touch down" locally is hardly confined to the Mexican apparel industry. In their study of the Chilean salmon farming industry, Phyne and Mansilla demonstrate that the relationship between the different links in this commodity chain, and in particular the organization of work in Chile's salmon farms, reflect in large measure the "historically-derived social relations in the Chilean countryside" (2003: 113). Phyne and Mansilla's analysis highlights the importance of Chile's class structure and local power relations in explaining both the organization of the export-oriented aquaculture industry and the extent to which domestic capital

[21] In explaining why "Moctezuma" attempted such an ambitious upgrading program when it did not appear to be in need it, Plankey Videla notes the importance of isomorphic pressures created by private consulting firms, international financial institutions, and state or local development agencies that encourage firms to undertake the type of restructuring that occurred at "Moctezuma." Research on GCCs in developing countries (or the transition economies) should pay particular attention to the mimetic and normative force that the upgrading discourse can assume, especially when that discourse derives as much from the dissemination of "applied" value chain analysis as from popular management philosophies.

[22] Plankey Videla's work also highlights the downside of the governance structure characteristic of buyer-driven chains. "Moctezuma" reorganized along lean production lines at the behest of the "big buyers" whose increased control over the commodity chain allows them to make ever greater demands on suppliers like "Moctezuma", although they are often unwilling or unable to provide them with the increased technical and/or financial support necessary to fulfill these expectations (Collins 2001;Dussel Peters, Ruiz Duran, and Piore 2002; Humphrey and Schmitz 2001).

and labor have benefited from the expansion of salmon farming in particular communities. One of the lessons to draw from their studies is that "[e]conomic actors…are always embedded in dense social and institutional networks of relations (including labour relations and state regulations) at both national and local levels, and these relations impinge in important ways upon the variability of economic development outcomes across space" (Smith et al. 2002).

In a very different geographic and industrial case, Paul Gellert's analysis of Indonesia's participation in the timber commodity chain, which emphasizes the importance of politics in shaping commodity chains, makes a similar point. Gellert shows how an oligopoly of timber-producing firms that forged an alliance with the state created an industrial association that effectively "upgraded" Indonesian firms along the chain from exporting timber to manufacturing plywood. The key figure in Gellert's story is a politically well-connected industrialist, Mohammad "Bob" Hassan, who transformed his "long personal and working relationship with President Suharto" into an effective institutional promotion of the Indonesian industry and an alliance with a Japanese trading company. Gellert argues that the ability of Indonesia to become a major exporter in the global (particularly Japanese) timber market reflects the "personal power of Hasan through his patron-client relations with President Suharto" (2003: 67).[23]

While most GCC research has focused on developing countries in Asia, Latin America, and to a lesser extent Africa, the economies of Eastern Europe and the post-Soviet space may provide particularly fertile empirical ground for understanding how institutional contexts shape commodity chains. Obviously, as a result of massive restructuring and reform in the "transition economies" over the course of the 1990s, firms in the post-socialist space have become incorporated into commodity chains in new ways. Global commodity chain analysis can help shed light on this process of incorporation and its possible consequences, but GCC research needs

[23] Gellert underscores the implications of his analysis for the upgrading construct when he argues that although one might interpret Indonesia's shift from timber exporter to plywood producer as a move up the commodity chain, "moving 'up' involves neither real movement nor, especially, national movement (as the image implies) as much as the capture of value-added or surplus value by particular actors as a result of political struggle along the chain": (2003: 55).

to be attentive to the particular ways in which "new" organizational forms are shaped by pre-existing institutional configurations (Stark 1992; Czaban and Henderson 1998; Sadler and Swain 1994). If commodity chains are understood as "situationally specific and socially constructed" (Gereffi, Korzeniewicz and Korzeniewicz 1994: 2), then how is the embeddedness of these networks in the larger institutional environment demonstrated? To what extent do commodity chains as a whole as well as their constituent parts exhibit features of path dependency?

Finally, insofar as the GCC framework is understood as a methodology for studying the dynamics and consequences of a capitalist world economy, research in this vein will do well to devote more attention on the *systemic properties* of contemporary capitalism. Can we explain similarities in the development of different commodity chains across industries in terms of systemic processes? For example, can we articulate the increasing salience of buyer-driven commodity chains with an analysis of structural transformation in the global economy?

As the literature on globalization has proliferated in recent years, many commentators have offered their interpretations of what has emerged as the cultural and economic form following the crisis of U.S. hegemony in the late 1970s, be it "the network society," a postmodern capitalism characterized by "time-space compression," or "empire" (Castells 2000; Harvey 1989; Hardt and Negri 2000). One set of analyses has focused on the "financialization" of global capitalism under U.S. auspices as the key to understanding the numerous phenomenon associated with the contemporary period: deindustrialization in the core economies, the East Asian "miracle" on the one hand and Latin America's "lost decade" on the other, and the rise of the Washington Consensus, which codified the set of policy prescriptions facilitating the shift from the development project to the globalization project (Arrighi 1994, Arrighi and Silver 1999, McMichael 2000). Arrighi, Silver and Brewer (2003) offer this argument in explaining why the rapid and widespread diffusion of manufacturing in the Third World over the last twenty years has resulted in industrial convergence between the global North and South (as measured by manufacturing as a percentage of GDP) without a corresponding process of convergence in the

income gap separating the former from the latter. Their analysis raises important insights that should challenge scholars of commodity or value chains to theorize the spatial and temporal limits of "industrial upgrading" in a contemporary global economy characterized by excess capacity in manufacturing.

Arrighi, Silver and Brewer favor a Schumpeterian analysis in explaining why much of the developing world, despite rapid industrialization, has failed to narrow the North-South gap. Schumpeter's theory of creative destruction contends that "major profit-oriented innovations are the fundamental impulse that generates and sustains competitive pressures in a capitalist economy" (2003: 16). Schumpeter emphasizes the temporal cycle of this process, identifying periods of "industrial revolution and the absorption of its effects" as the alternating phases of "long waves in economic activity" (1976: 67), but Arrighi, Silver, and Brewer suggest that while Schumpeter argues that "profit-oriented innovations…cluster *in time*," one might also explore their *spatial* clustering in order to understand how the North-South divide is reproduced under global capitalism. Profit-oriented innovation tends to originate in the wealthier countries of the developed world, and as Vernon (1966; 1971) recognized, when new technologies and processes mature and diffuse to the poorer countries, "they tend to be subject to intense competition and no longer bring the high returns they did in the wealthier countries" (Arrighi. Silver and Brewer 2003: 18).

For Schumpeter, the process of creative destruction was the essence of capitalism's evolutionary character, as "a form or method of economic change" that "not only over never is but never can be stationary" (1976: 82). Competition between firms to innovate characterizes all global commodity chains, but as Arrighi, Silver, and Brewer emphasize the process of creative destruction has a spatial element whereby successful innovation does not occur randomly, but is much more likely to cluster in the wealthier countries of the global North. One fruitful direction for GCC research would be to apply the chain concept to explain how dynamics of power and

profitability in global industries differentially shape the returns to firms participating in commodity chains, particularly those from developing countries.

In this recent article, Arrighi points to the same research question suggested in his 1986 article with Jessica Drangel: can one explain the stratification of the world-economy through the construct of global commodity chains? In this earlier article, the authors hypothesize that a country's position in the world-economy reflects the mix of "core" and "peripheral" activities it (or presumably its firms) perform in the various commodity chains in which it is involved. Arrighi and Drangel are interested in ascertaining the extent to which the stratified structure of the world-economy has changed over time, and rather this suggests a process of "catch-up" between the semi-periphery and the countries of the advanced, capitalist core. It is not clear from their analysis how the profile of activities being performed at the country (or firm) level aggregate up to the national economy's position in the world-system, nor do they explore in detail the question of what constitutes core versus peripheral activities. However their discussion suggests that the degree of competition characterizing a node in the chain determines an activity's status as either core or peripheral. Widespread industrialization in the semi-periphery and even much of the periphery means that the links in the commodity chain having to do with the actual production or manufacturing process are characterized by increasing competition, leading to the observed outcome that "the industrialization of the semiperiphery and periphery has ultimately been a channel, not of subversion, but of reproduction of the hierarchy of the world-economy" (56).

A commodity chains approach can contribute to this line of inquiry by allowing us to study how patterns of inequality between the global North and South are reproduced, in part, by the organization of international production networks and the relationships between firms located at different points in global commodity chains. Existing research on the competitive dynamics of chains, such as the various types of rents generated through the process of upgrading, which serve as barriers to entry for potential competitors (Schmitz and Knorringa 1999; Kaplinsky 2000), can

inform this research agenda. In fact, asking how commodity chains reproduce and reinforce inequality in the global economy can be read as the obverse but apposite question of the one that orients current value chain research: how can developing countries leverage participation in these chains to benefit various constituencies, including firms, workers, and communities. Regardless of which way we ask the question, I have tried to argue in this paper that the second generation of commodity chains research should expand the scope of analysis to include the various factors external to the chain—including the regulatory, institutional, and systemic contexts in which they operate—affecting the organization of these chains as well as the developmental outcomes associated with them. While this next generation of research should build on the impressive achievements of the first, the value of the GCC approach can be strengthened by paying greater attention to these factors, and how they mediate the implications of participation in commodity chains for firms and workers in the global economy. This will advance our understanding not only of how commodity chain dynamics might be leveraged to advance the goal of firm-level industrial upgrading, but also how these chains, and the political and social relations in which they are embedded, contribute to the process of uneven development characterizing contemporary global capitalism.

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Labor and the Global Logistics Revolution

I am working on a book that focuses on the ports of Los Angeles/Long Beach as a critical node in the global production and distribution system. Each of these ports is the largest container port in the US. Together they are the third largest container port in the world. They serve as a major gateway for the importing of manufactured goods from Asia, especially China. Most of the imported goods are distributed to the rest of the United States intermodally—by a combination of truck and rail.

The book is divided into three sections. Part I examines the logistics revolution, involving a shift from push to pull production, and the development of logistics as a "science" of supply chain management. A concomitant of this revolution has been the increased power of retailers (commercial capital), who now dominate the importing of manufactured goods. This shift in power has implications both for producers/

manufacturers, who are being forced to move offshore in the pressure to lower prices, and for logistics (transportation and warehousing) providers, who have also been forced to rationalize and cut costs. Wal-Mart is a leader in these changes. As the world's largest corporation in terms of sales, it is also the US's largest importer, and exercises considerable muscle over processes of production and distribution.

Part II turns to the question of how the freight is moved. I examine the rise of the Southern California ports, as a product of the development of intermodal transportation, so that ships from Asia can discharge cargo on the West Coast, and need not sail to the East, although it is the major center of economic activity in the US. I consider the major steamship lines which transport containers, and the role they play in intermodal freight transportation. I also look at ground transportation, including the port trucking companies, which dray containers to rail heads and warehouses, the railroads, which transport goods to the rest of the country, and TL trucking companies, which increasingly combine with the railroads for national transportation purposes. These transportation industries have all experienced deregulation since the late 1970s, and have undergone major restructuring and consolidation. Finally, I turn to warehousing and distribution centers (DCs) in Southern California, which has become a major center for the transloading of cargo into domestic containers and trailers. The West End of the Inland Empire has developing into a DC powerhouse for many of the US's largest corporations, including the giant retailers. Some corporations have outsourced their logistics functions to third parties, known as 3PLs, a sector that has grown in recent years. The development of this giant importing complex has created serious problems in terms of congestion and pollution, leading to community rebellions of various kinds.

In Part III we turn to the implications for labor. The logistics revolution has led to a definite decline in logistics costs, in part by increasing efficiency and turn around time. Principles of just-in-time (JIT) are now being applied throughout the system and up to the retailer level. The goal is to have goods constantly in motion. Our question is: how much of the cut in logistics can be accounted for by cutting labor costs, and how much have logistics workers been hurt by these changes? Various groups of workers are considered: seafarers on the container vessels, longshore workers, railroad workers, port truckers, long haul truckers, and warehouse and DC workers. While there is considerable variation among them, with each group facing its own unique circumstances, there has been a

tendency to increase the use of contingent workers, and to weaken the transportation unions. The West Coast longshore workers and their union, the ILWU, remain a stark exception, but efforts have been underway for a period to break their hold on a strategic node in the distribution system.

Finally, we end with the political implications of the study. As a critical gateway for Asian production, the ports of LA/LB (and other Western hemisphere container ports) serve as a bottleneck in the system. Given the need for the timely and continual flow of goods, a vulnerability has become evident. This West Coast ten-day lockout of the ILWU in late 2003 demonstrated the weakness, as it was estimated that the country's businesses lost at least $1 billion a day. This weakness could be used by labor to develop coalitions between Asian production workers and local distribution workers to place demands for change of the current corporate-dominated system of global production and distribution. A question arises: if we were in a position to rewrite the rules of the game, what would we ask for?

Implications for GIS and Network Analysis

The logistics system is a highly networked phenomenon. Let us take a company like Wal-Mart as an example. They employ hundreds, perhaps thousands of suppliers around the world. These companies produce the goods that Wal-Mart sells, often to Wal-Mart's specifications. Wal-Mart also employs numerous service providers, including transportation and warehousing companies. For example, while they use almost every steamship line, they have a special relationship with Maersk, the largest steamship company in the world which operates Terminal 400 at the Port of LA. They also use the BNSF railroad (as opposed to Union Pacific), and, though they have their own trucking fleet, they have a strong relationship with J.B. Hunt trucking company, and use Schneider. They employ Exel as the 3PL that runs their giant (2.7 million square feet) DC in the Inland Empire. And so on. All of these relationships are contingent. Hardly any involve long-term contracts, so they shift, depending on cost and availability. Any network that one could map would have to be considered as short-term or even momentary. Yet there are undoubtedly some stabler patterns among the shifting sands.

In principle, each container could be tracked, from its origins in Asia to its destination in the U.S. Moreover, if the container is transloaded in the LA basin, as is becoming more common, the goods that are in it could all be tracked. Since every parcel is bar-coded, and since now more companies are instituting RFID (radio frequency identification) under compulsion from Wal-Mart, the entire supply chain is increasingly transparent to the shipper (importer). The shippers are getting to the point where they are able to track everything, and to locate exactly where it is at each moment. Getting access to these kinds of data might well be a GIS expert's dream come true, although the volume of information is overwhelming. The problem is that the information is all proprietary, and the companies are exceedingly secretive. They don't want others to know who their Asian contractors are, let alone what they are producing and how it is being moved. Some information is forced out of them by Customs, and increasingly in the name of national security, but there is still plenty of obfuscation. For example, PIERS, the subsidiary of the Journal of Commerce that collects detailed information on Bills of Lading, and analyzes and sells it for exorbitant fees, is notoriously inaccurate at the firm level because the companies hide their identity behind 3PLs or find other ways not to reveal who is the real shipper. Every year the Journal of Commerce puts out a list of the top 100 importers (and exporters) by number of TEUs, and this requires extensive additional research to come up with even ball-park estimates.

Even the mapping of what comes through the ports is made difficult by the fact that the Customs District is not confined to the ports of LA/LB themselves, but includes all the airports in the district as

well as a couple of nearby smaller ports. The ports themselves collect data, but it is not clear to me whether it is any better than the PIERS data, and again it is proprietary, so they are generally unwilling to share it.

If someone were to get serious about trying to map and develop a network analysis of even a small portion of these data, I think what would be required would be either a close relationship with Customs so that they would be willing to share the data (though it is hard to imagine that they would provide confidential and proprietary information), or a close relationship with a particular company such that it would allow one to look at its data, or cozying up to a logistics consulting firm that might be willing to share data on one of its clients (again, very unlikely), or spending suitcases of money analyzing PIERS data with the full knowledge that it is flawed, or hacking into some company's logistics system. Short of this, I think we can get some bigger picture connections, based on piecing together various sources of information. In following Wal-Mart around a bit, I did discover some information about their logistics providers. But this is a broad brush investigation. They are secretive to the point of paranoia, and I have found it impossible to get a direct interview with one of their logistics people.

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Since the 1980s a good part of my research effort has tried to map structures of corporate power, using interlocking directorates as the key indicator. [1] The literature on interlocking directorates is vast, and theoretical interpretations range from organizational models of exchange and resource dependence (Pennings 1980; Pfeffer 1992) through radical elite formulations of C. Wright Mills (1956) and William Domhoff (1998). In my research program I have drawn primarily upon two streams of Marxist theory. One, beginning with Hilferding (1981[1910]), situates corporate interlocking within the circuitry of **capital accumulation** under conditions monopoly capital; the other, beginning with Gramsci (1971), sensitizes us to the importance of corporate networks as vehicles for **class hegemony**. These formulations enable us to grasp two complementary forms of corporate power, the first residing within the actual practices of surplus value appropriation and capital circulation that fall under the strategic control of corporate directors, the second entailing the formation of business communities whose shared world view underwrites an ongoing bid for hegemony in civil society and the state (Carroll 2004, chapter 1).

Representing Spatiality in the Transnational Corporate Network

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Introduction

Since the 1980s a good part of my research effort has tried to map structures of corporate power, using interlocking directorates as the key indicator.[1] The literature on interlocking directorates is vast,[2] and theoretical interpretations range from organizational models of exchange and resource dependence (Pennings 1980; Pfeffer 1992) through radical elite formulations of C. Wright Mills (1956) and William Domhoff (1998). In my research program I have drawn primarily upon two streams of Marxist theory. One, beginning with Hilferding (1981[1910]), situates corporate interlocking within the **circuitry of accumulation** under conditions of monopoly capital; the other, beginning with Gramsci (1971), sensitizes us to the importance of corporate networks as vehicles for **class hegemony**. These formulations enable us to grasp two complementary forms of corporate power, the first residing within the actual practices of surplus value appropriation and capital circulation that fall under the strategic control of corporate directors, the second entailing the formation of business communities whose shared world view underwrites an ongoing bid for hegemony in civil society and the state (Carroll 2004, chapter 1).

Most research in this field has focused on specific countries, where, in conjunction with broader structural tendencies toward capital concentration and centralization, and the integration of the forms of capital within larger blocs of finance capital, specific legal and cultural histories have given rise to distinctive business systems (Scott 1997; Whitley 1999). My 2002 study, "Is there a transnational business community," conducted with Meindert Fennema, emphasized the difference between the voice-based systems of organized capitalism that have prevailed particularly on the European continent, generating dense corporate networks on the basis of long-term capital relations, and the Anglo-American exit-based systems, centred more around stock markets, that have generated sparser corporate networks and weaker inter-corporate ties. In that study we found a modest increase in transnational interlocking, but also a persistence of national specificities, and a trend away from the strong inter-corporate ties that have been distinctive of organized capitalism. We concluded that a transnational business community, centred on the North Atlantic, is in the making, and that its practices seem directed more toward socio-cultural class formation than toward the strict instrumentalities of transnational strategic control of capital accumulation.

A subsequent study with Colin Carson, published in the *Journal of World-Systems Research* (Carroll and Carson, 2003), broadened the network analysis to include 350 corporations as well as five policy-planning groups that have been important promoters of neoliberal globalization in one form or another, namely the World Economic Forum (WEF), International Chamber of Commerce (ICC), Trilateral Commission (TC), Bilderberg Conference and World Business Council for Sustainable Development (WBCSD). Although we considered only one point in time – year-end 1996 – our analysis was able to establish the enormously integrative role that the policy boards (themselves extensively interlocked) play in pulling together directors of the world's largest corporations into the social spaces within which they can forge collective political

projects. We found, however, that the policy boards performed this integrative function unevenly, in effect reinforcing the relations of centrality and marginality in the corporate network of interlocking directorates.

Today I want to take the network analysis of the Global 350 corporations and the policy groups a bit further. My emphasis will be concrete and empirical, and in keeping with the theme of this workshop I will highlight the spatiality of the network, although I will not be able to do justice to the theme of change. The key issue is what a spatial network analysis, mapping corporations by their countries and cities of domicile, can reveal about the structure of global corporate power at the close of the 20th century.

Participation and Centrality in the Global Network

This analysis is limited to a subgroup of the 622 interlocking corporate directors that Colin Carson and I studied; namely, the 222 people whose corporate and/or policy-board affiliations actually carry the entire **transnational** network. In leaving aside the 400 directors who direct only corporations in one country, we can derive a clearer sense of positions in the transnational network, one uninfluenced by the purely domestic ties that actually predominate in the global corporate network.[3]

I want to focus first on the network that is created by the 94 individuals whose corporate directorships span national borders – the transnational linkers. These 94 cosmopolitans hold 266 directorships in a total of 122 leading corporations. That is, **only 122 of the Global 350 participate at all in transnational interlocking**, underlining the relative rarity of this practice, compared to the traffic among the boards of companies based in the same country.

Consider, first, which countries of corporate domicile emerge as heavy participants in the network. **Slide 6** breaks down the Global 350 by country of domicile and shows how many firms within each country participate in transnational interlocking. Although the US contributes the greatest number of large corporations to the Global 350, the directorates of those companies do not participate in transnational interlocking to any unusual extent. Just 35 of 90 US-based corporations engage in transnational interlocking – slightly less than the 38 (of 57) firms based in France and Germany that participate. Large firms based in Canada resemble American firms in their rate of participation. Japanese firms are particularly isolated, as are companies domiciled on the semi-periphery. It is European corporations – particularly those domiciled in north-west Europe – that are the heavy participants in the transnational network. Although corporations based in north-west Europe comprise a scant third of the Global 350 (32.9%) they make up 58.2% of the transnational corporate network. Southern European firms tend to be peripheral, with Italian and Spanish companies rarely participating and Greece and Portugal lacking any membership in the Global 350.

Now consider the distribution of network participation across cities (**Slide 7**). The 22 cities that each host four or more corporations account for 241 of the Global 350, and four global cities – Tokyo (52), London (29), New York (24) and Paris (24) – are host to a total of 129 corporate head offices. But cities vary tremendously in the degree to which the firms they host participate in transnational interlocking.[4] The network is

overwhelmingly based in the cities of the northeast of North America and the northwest of Europe, with Paris, London and New York claiming the most network participants.[5] On the North American side, the zone for what Van der Pijl (1984) has aptly called a (north) Atlantic ruling class does not extend to Dallas or San Francisco; on the European side the zone does not reach Rome, although two companies based in Milan do participate. Within the zone of participation, certain cities – Zurich, Frankfurt, Dusseldorf, Paris and Chicago, for instance – are particularly hooked into the transnational network.

Network participants can be further differentiated as to how central they are. A basic measure of centrality is degree – the number of interlocks with other boards that a given board has, which varies in our network of 122 firms from 1 (28 firms have only one tie to the network) to 20 with a mean of 4.59 and median of 3.30. However, in assessing centrality we need to recognize that not all interlocks are created equally. We can distinguish between **primary and secondary interlocks**: the former carried by corporate insiders, the latter by outside directors. Simply put, a situation in which, say, the CEO of Deutsche Bank sits on the supervisory board of Daimler-Benz is more substantively important than an interlock carried by an outside director of two companies.[6]

Note further that primary interlocks may be said to have directionality, although not without some ambiguity. Typically, an executive in one company who sits on the board of another may be said to represent the interests of the former in the strategic direction of the latter. Out-degree refers to the number of interlocks in which a given board "sends" one of its executives to another board; in-degree refers to the number of interlocks in which a given board "receives" executives from other firms who are appointed to its board as outside directors .

In **Slide 8** it is clear that in relative terms companies based in the US, UK and southern Europe are minor participants in the transnational corporate network compared to firms based in northwestern Europe and Canada. This is true for all three components of degree. Anglo-American companies do not send their executives to other boards, whereas corporations based in France, Germany, the Netherlands, and Canada show substantial out-degrees.[7] It is rare for Anglo-American companies to receive executives from other companies in the network, although this also applies to firms based in Canada and especially the Netherlands, Switzerland and Sweden. Incoming primary interlocks are most common among companies based in France and Belgium, suggesting a heavy incidence of inter-corporate strategic control there. Finally, firms based in Britain and the United States average only two secondary interlocks compared to a range between four and eight for firms based in northwest Europe (except Sweden) and Canada.

So, while a considerable number of American- and British-based corporations **participate** in the transnational network, they tend to be **peripherally positioned** and to engage in only **weak ties**, compared to firms based in northwest Europe and Canada. As for companies sited outside of the North Atlantic, they rarely participate, and when they do they inhabit the margins of the transnational network.

We can get a more concrete sense of the transnational network's spatial distribution by mapping a sociogram of all interlocks among the 122 corporations. We find that all but 10 of the 122 form a single connected component (**Slide 9**), but that non-European firms tend to be on the dominant component's periphery while French and German firms are at the centre.[8] Among the US-based firms only IBM and Xerox can be said to be reasonably well-ensconced in the network. Among Canadian-based firms Seagram and especially Power Corporation are relatively central, and mainly tied in with French and Belgian capital.

Components in the Network of Primary Interlocks

In view of the importance of interlocks carried by executives in the strategic control of corporate capital, it is worthwhile to map the network of primary interlocks. In all, there are 80 primary (i.e., officer) interlocks in the transnational network, and here especially, the European firms predominate.[9] Fully 51 of the 66 firms whose boards are involved in at least one primary interlock are European-based, as are all but two of the 17 companies with three or more primary interlocks. To the extent that primary interlocks indicate functional and/or strategic relations between firms, we can say that most transnational interlocks of this sort are contained within the EU.

The dominant component shown in **Slide 10** includes 41 companies, 32 of them based on the northwest European continent, including 13 French and 14 German. Only two British, five American and two Canadian firms participate in this connected network of officer interlocks, and no companies based outside of the North Atlantic belong to the component. When we restrict ourselves to interlocks carried by executives, British and North American firms become more peripheral; while Europe appears as integrated around a Franco-German core, with participation from capital based in the Netherlands and Canada. Many of the primary ties in Slide 10, however, are contained **within** national borders, even though our methodology purposefully accentuates the transnational aspect of the network. That the core of the network is continental-European reflects the growing importance of EU as economic community, and indeed a federated state. The single exception to this pattern is Montreal-based Power Corporation, the investment vehicle for the Desmarais family, whose trans-Atlantic alliance with the Belgian Frere family has projected it into a position of shared strategic control over several large European corporations, including Fina (Carroll 2004: 64-5). The case of Fina, which largely accounts for the plethora of incoming primary ties we observed earlier for Belgian firms, shows how the network of primary ties is built around relations of strategic control and coordination – as in the shared control of Fina prior to its merger in 1999 to form TotalFinaElf.

The exceptional position of Power Corporation, a holding company whose assets are purely financial, raises the broader issue of how the two primary forms of corporate capital appear within the network. We can see in Slide 10 that financial institutions (shown as triangles) play an important role in integrating the continental-European core, but that the British and American firms on the network's periphery are industrial TNCs.[10] While Anglo-American financial institutions are conspicuous by their absence, twelve of the continental-European participants are financial institutions. Such institutions as

Deutsche Bank, Dresdner Bank and Union des Assurances de Paris interlock with their respective national corporations but also link across borders, and particularly the German-French frontier. Deutsche Bank is especially cosmopolitan in sending members of its management committee to the boards of French, British and American companies.

Mapping the Inter-Urban Network

Given that 'cities with a concentration of head offices may be considered management centers' (De Smidt, 1991:148), it is worthwhile to condense the corporate network into an inter-urban network. To do this we treat cities as points and the total number of interlocks between firms headquartered in two cities as a line, whose strength may vary (cf. Green and Semple, 1981, Kono et al., 1998). When we aggregate points and lines to the level of cities, what do we learn?

Slide 11 displays all inter-urban interlocks between the 48 cities whose firms participate in the transnational corporate network. We find major between-country differences in the extent to which transnational interlocks connect to a range of cities or are focused on the main metropole. London and Paris dominate their respective countries as singular nodal points–the network of transnational interlocks is effectively contained within these cities. But in Germany and the US there is wider social space among a plurality of cities hosting corporations in the global network. A second finding of note is the nearly complete fissure between American cities and certain major continental-European cities – particularly Paris (effectively France).[11] US-based firms hook into the European business community mainly by way of London, and secondarily via Frankfurt and Zurich. London certainly emerges from this analysis as a key articulation point in the North Atlantic network, in tandem with New York.

Consider now the 15 most central cities in the inter-urban network (**Slide 12**). Paris is by far the leader, with a total of 74 interlocks extending to corporations based in other cities – all of them outside of France, but most of them on the European continent, where Paris appears as corporate capital's dominant urban centre, with 25 interlocks to Brussels, six to Frankfurt, and 13 reaching across the Atlantic to Montreal. London is also central,[12] and again all of its interlocks extend to cities beyond Britain, with five terminating in Hong Kong, five in New York, three in Washington and three in the Hague/Rotterdam. New York, by comparison, is sixth-ranked, and seven of its 28 interlocks lead to other American cities. Still, New York's 21 transnational interlocks are spread widely among 10 cities, the key ones being London (5), Frankfurt (3), The Hague/Rotterdam (3) and Montreal (3). Overall, only three North American cities place in the Top 15, compared with twelve European cities.

To get a clearer sense of the main inter-urban linkages in the corporate network, we can reduce the network to its most tenacious relations, by sequentially ratcheting-up the criterion for inter-urban linkage. When in **Slide 14** we limit the analysis to two or more interlocks between cities, most of the ties linking North American to European cities fall away. The main exceptions are Montreal's strong ties to Paris and Brussels, New York's strong ties to London and Frankfurt, and Washington's ties to London. When we raise the level to 3, 4, or 5 interlocks (**Slides 15-17**) we find two inter-city clusters, one centred

around Paris and including continental cities as well as Montreal; the other centred around London and including New York, Hong Kong and Rotterdam, where Dutch-British Unilever is based.[13] Ultimately, the inter-urban network reduces to a Paris-Brussels-Montreal axis that largely reflects the profuse interlocking within the trans-Atlantic Desmarais-Frere financial group (**Slides 18-19**).

Bringing in the Global Policy Groups

Finally, how does the picture change when we include the global policy groups and the corporate directors who in sitting on those boards provide an additional layer of transnational social organization? When we add to our 94 transnational linkers the 128 other corporate directors with at least one tie to a global policy group the number of Global 350 companies that participate in the network rises to 193, 187 of which form a single connected component. **Slide 20** maps the dominant component in a way that allows us to visualize the location of the policy groups and the spatial distribution of corporate domicile. To produce this sociogram I first included only the corporations that were interlocked directly or indirectly with each other, and mapped them in the two-dimensional space according to their proximities in the network. They appear as a dense configuration in which national clustering is quite evident. I then added the five policy groups and the firms that are interlocked with the policy groups but otherwise isolated from the corporate network. Note that elite interlocks with policy boards, particularly the TC and WBCSD, not only provide an additional layer of elite social organization for companies that already participate in the corporate network. They also bring many more Japanese and American corporate boards into the network. Although the ICC's board does not interlock with many corporate boards the other four policy boards interlock extensively with each other and serve to integrate European, North American and (in the cases of the TC and WBCSD) Japanese segments of the transnational business community.

As we did earlier, here again it is illuminating to condense this highly complex formation into the inter-urban network (**Slide 21**). Not surprisingly, we find 17 more cities now represented in the network, including several urban centres of the semi-periphery (Johannesburg, Seoul, and Istanbul), as well as such minor American centres as Bartonville, Arkansas (home to Wal-Mart, which is interlocked with the TC).

As we step up the criteria for participation (**Slides 22-27**), the minor cities fall away quickly. But in contrast to our earlier results the network does not break apart. It continues to be integrated across the three zones of the triad, with the TC and WBCSD playing the key integrative roles (see particularly Slide 23). This is hardly a startling result, but when set against the international and inter-urban differences in network participation and centrality it suggests that the key sites for transnational capitalist class formation may not be the corporate boardrooms, but rather organizations defined on the terrain of civil society. When we raise the criterion to 12 or more interlocks (**Slide 24**), the Paris-based segment of corporate capital continues to be linked into its counterparts in New York, London and Tokyo, by virtue of common participation on the TC. Ultimately, the global corporate-policy network reduces, in **Slide 27**, to the bundle of 31 interlocking directorships that link New York-based corporate capital to the Trilateral

Commission. Thus, although New York's position in the corporate interlock network is not so strikingly central, the same cannot be said once we include the policy groups.

Discussion

Let me try to place some of these findings in context and then make some methodological suggestions. Our reading of the transnational corporate network needs to take account of several tendencies that have actually been **weakening** corporate networks – the shift from relationship-based to transaction-based corporate finance and even the disintermediation of corporate finance; the pressures to reform corporate governance practices, particularly in the Anglo-American countries, in response to a seemingly unending series of scandals and collapses that have disturbed the institutional investors that control increasing concentrations of share capital. There is also the tendency, as regional trade agreements such as NAFTA take effect, for board-level interlocks between corporate parents and their foreign subsidiaries to be converted into closer ties at an operational level.[14] Thus, even as capitalism's circuitry has become more globally integrated, elite corporate networks have become lighter, and even sparser. There is no reason to expect a cumulative process of densification in the transnational corporate network, so it is not surprising that Meindert Fennema and I found only a modest increase between the mid-1970s and 1996. There are actually some tenacious obstacles to a rapid articulation of a global elite corporate network – legal (differences in corporate and financial law), linguistic/cultural, ownership-based[15] and geographic (think here about Australia's distance from Europe). From the proximities of countries and regions within the corporate network we can infer that these obstacles apply much more strongly between, say Japan and Germany than among the countries of a Europe that has embraced economic integration.

Nationally and regionally specific business systems have engendered path dependencies in the transition to globalized capitalism, which are evident in our findings. For quite different reasons, corporate interlocking is a relatively uncommon practice in Japan and the US, [16] and this alone could account for the marginality of many Japanese and American firms in the transnational network. Britain has had as diffuse a business system as the US (Scott 1997), but capital ties to the nearby European continent (especially the Dutch connection) and a colonial legacy linking London to Hong Kong raise London's profile. It is on the European continent that we find the densest clutch of transnational interlocks (including most of the primary ties), spanning mainly across countries of the north-west.[17] This network is more than just a recent by-product of the formation of EU; its path dependencies – as in the propensity for strong ties between financial and industrial forms of capital – reach back to the inception of organized capitalism. As national borders on the continent weaken, capital relations deepen, particularly along a Franco/German axis.[18]

It is clear from our analysis that the transnational network is concentrated in a few cities, some of which entirely dominate their respective countries. And it is striking how detached Paris is from New York and other American cities, and how central Paris is on the continent. Although the corporate network is essentially a North Atlantic formation, it seems to have two segments, one Anglo-American and the other continental-European,

with corporations based in London and the Hague/Rotterdam conjoining the two. The parallels with recent trends in international relations are intriguing. But to comprehend inter-urban and international ties we need to consider the basic levels – those of individuals and corporations – on which the network exists (Carroll 1984). For example, we can only understand the strong link between Montreal and Brussels in terms of specific corporations and the capitalists in control of them, who comprise the only truly transnational financial group. Earlier in-depth analyses of local corporate network have yielded great insights, as in Ratcliff's (1980) study of St. Louis, or Zeitlin and Ratcliff's (1988) analyses of the Santiago-based ruling class in Chile. Case-study of local networks and their articulation with the transnational network holds promise as a means of tracing out the concrete relations that constitute global corporate power. In considering the positions of semi-peripheral cities such as Sao Paulo, Johannesburg and Seoul in that global structure, intensive case study would seem the best strategy. Such a targeted approach would be more effective than trying to represent semi-peripheral capital by adding a few dozen corporations to a collection of the world's largest firms that will otherwise be restricted to the world system's core.

Besides case studies, we need to broaden our understanding of the network to include more nodes and lines, and more kinds of nodes and lines. When we include ties to the global policy boards alongside the corporate interlocks we get a different view. Suddenly the directors of Japanese corporations are in the game. And with the Trilateral Commission in the network American (particularly New York based) corporations become anything but marginal. This shows that capitalists based in the US are heavily invested politically in the transnational business community, even if their directorate-level ties to foreign capital are sparse. It also suggests that the most important relations in the formation of a *transnational* capitalist class may not be those that are caught up in the instrumentalities of accumulation, but those that seek to forge political solidarities around hegemonic projects.[19]

Besides corporate links to business councils, economic forums and the like (whose numbers could be multiplied far beyond this study's purview – see Plehwe and Walpen, forthcoming), an additional layer of weak ties between corporations awaits further study. Many global companies have established international advisory boards, operating at one remove from corporate strategy, which in attempting to improve business scan recruit leading local and global advisors. An advisory network, running parallel to the corporate network *per se*, may be said to make its own contribution to transnational class formation. Its structure needs to be probed and mapped. As for the more instrumental relations, based in the actual control of capital accumulation, it would be worthwhile to trace the global network of inter-corporate ownership and relatedly the strategic alliances between corporations in certain sectors such as telecommunications.[20]

In short, we need to view global business networks as **multiplex** in their relations, as well as **nested**. To make sense of the transnational network we need to appreciate national and regional specificities and to shuttle analytically between the distinctive sites and levels at which a transnational business community, or capitalist class, can be discerned – those of individual capitalists and their organic intellectuals, of corporate boards, of the cities that

host major corporations, of the countries that make up the inter-state system, and of the regional blocs in which the countries are embedded.

All these practices, relations and sites, are located not only in space but in time. In this paper I have focused on a single cross-section, referring to a situation seven years ago, on the threshold of the Asian financial crisis. Much has transpired since then in the political economy of the world system, and there is a pressing need for more recent data to enable a dynamic analysis that can discern change and emergent features. My advice on this issue is that where feasible a single-year time step be used, so that macro-level events (such as the Asian crisis and its aftermath in other countries) as well as micro-level events (such as major corporate reorganizations) can be fully examined with an eye to their immediate and longer term impact.

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[1] Most of my work in this area has focused on the case of Canada (Carroll, 1982; 1984; 1986; 1989; Carroll and Lewis 1991; Carroll and Alexander, 1999). My most recent book, *Corporate Power in a Globalizing World* (Oxford, 2004), attempts to place the Canadian network in a broader context.

[2] See for instance Fennema and Schijf 1979; Mizruchi 1996; Scott 1997.

[3] In view of that predominance, 'local' interlockers must be put to the side in considering a corporation's centrality in the global network – otherwise the local densities of national segments will predominate in the calculation. For instance, a firm based in France with no transnational ties but many ties to other large French companies would appear quite central in the network, although in fact it would be isolate from transnational interlocking per se.

[4] The contingency coefficient for the relationship between the two variables depicted in the graph is .522.

[5] Note that the manner in which we assembled our sample favoured British-based corporations to some extent, which is why London appears as particularly prominent. (see Carroll and Carson, 2003, for methodological details). Half of the London-based corporations, though all of them large industrial corporations, were slightly smaller than the quantitative floor criterion for inclusion in the Global 350. However, most of the London-based participants in the transnational network (10 of 14) met the quantitative size criterion. Among the 15 smaller London-based firms, only four participated in the transnational network, namely British Airways, Grand Metropolitan, Smithkline Beechham and the mining transnational RioTinto (RTZ-CRA Group). The complexities and pitfalls in assembling delimiting the network of the world's largest corporations are discussed in (Carroll and Fennema, in press).

[6] Actually, many of the secondary ties in a corporate network are created incidentally ("induced", to use the terminology of the 10 countries study – Stokman et al, 1985), when an executive in one firm sits as an outside director on several other boards. Such an executive will create secondary interlocks between each of the boards on which he sits as an outside director. For instance, an executive who is also an outside director of five firms creates five primary interlocks plus 5*4/2=10 secondary interlocks. The most extensive analysis of corporate networks in terms of primary and secondary interlocks was undertaken by Stokman, Ziegler and Scott (1985) and their colleagues.

[7] As does Broken Hill Proprietary, the sole Australian-based company in the transnational network.

[8] The network in Slide 9 was drawn according to a spring embedding algorithm -- the goal being to place every pair of vertices at a distance proportional to its graph-theoretic distance. Thus, the distances in the sociograms are meaningful indications of distances in the network. I used Steve Borgatti's NetDraw.

[9] Only one US firm has an outdegree greater than unity (Xerox: 3) and only one further US firm has an out-degree of 1 (MCI). In comparison, 5 French, 4 German, 2 Swiss, two Dutch, one Canadian and one Australian firm have out-degrees of two or more. Out-degree sometimes indicates a company's influence over other firms – eg Deutsche Bank, which is the leader in the network. Only one US firm has an in-degree greater than unity (Sprint: 2); another ten have in-degrees of one each, and, intriguingly, in most of these cases it is European executives who sit on the boards of American corporations. Nine French, four German and one Belgian firm have in-degrees of two or more. In-degree sometimes indicates dominant

influence in a firm by capitalist interests also associated with the other firms. Belgian-based Fina, which in 1999 merged with two French-based petroleum firms, has an in-degree of five.

[10] With the exception of Morgan Stanley, whose board includes an executive from Canadian-based Seagram.

[11] In 1996 there was only one director of both French and American-based companies, namely, Rand V. Araskog, former CEO of ITT and an outside director of Hartford Financial (based in Hartford), Dayton Hudson (based in Minneapolis) and Alcatel (based in Paris).

[12] Recall, however, from endnote 5 that our Global 350 includes some British-based firms whose revenues did not meet the formal size criterion. The four London-based companies in question – British Airways, Grand Metropolitan, Smithkline Beecham and Rio Tinto – are certainly large, and internationalized in their operations. Together, they participated in 11 transnational interlocks at year end 1996. If we were to leave these aside, London's aggregated degree would fall to 30.

[13] The two Anglo-Dutch transnationals in the Global 350 have head offices both in London and the Netherlands (Unilever in Rotterdam, Shell next door in The Hague). These cases of corporate bi-nationality, the only two in this study, show the difficulties in "locating" highly transnationalized capital in one domicile. My (arbitrary) categorization of both firms as based in the Hague/Rotterdam partly mitigates the over-representation of London-based firms in the Global 350. See endnotes 5 and 12.

[14] I explore these network-weakening tendencies in depth in Carroll 2004, chapters 2 and 4.

[15] Most corporations in the world are controlled within single countries, and the composition of their directorates tends to reflect that. The Anglo-Dutch examples of Shell and Unilever (50% owned in Britain, 50% in the Netherlands) are exceptional; the Daimler-Benz takeover of Chrysler is the norm.

[16] In Japan, corporate capital has been organized into tightly-knit groups on the basis of cross-ownership of shares, but corporate directorates tend not to interlock very extensively. Instead, companies send executives to each other, who later return to the original posting – the "interlock" exists as a temporal flow of personnel. This practice, perhaps combined with language barriers and the disincentives posed by Japan's spatial location, helps explains why Japanese-based corporations are so marginal in the corporate network. American capitalism has been organized more around the stock exchange than around institutionalized financial-industrial relations of organized capitalism, so the corporate network has long been loosely knit, and became looser as certain corporate governance reforms were implemented in the 1980s and early 1990s (Davis and Mizruchi 1999).

[17] As I have reported elsewhere, the mean degree of interlocking among the 81 dominant corporations domiciled in the northwestern corner of the European continent (7.605) is actually higher than the mean among the 90 US-based firms in our Global 350. In this sense, "*the corporate elite of northwestern Europe is more socially integrated than the American corporate elite"* (Carroll 2004: 142).

[18] Canada bears some resemblance to Europe in its more centralized banking apparatus with a history of dense ties to industry, and in its corporate empires based on inter-corporate ownership, one of which now links Montreal to Brussels and Paris in the strongest set of trans-Atlantic ties, and the only case of a truly transnational financial group.

[19] On the concept of hegemonic project see Jessop, 1983.

[20] Some of the small components that turned up in my analysis of primary interlocks point up the importance of these partnerships. I found a particularly strong set of reciprocated executive interlocks between US-based MCI Communications and British-based BT. An archipelago of primary interlocks reaching from Deutsche Telekom through US-based Sprint to France Telecom and then to Telefonos de Mexico was also evident.

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Globalization is everywhere. States, economies, and societies are increasingly integrated; flows of goods, capital, humans, and cultural objects now link us in a global web. There is little doubt that we are undergoing a process of compression of international time and space. Globalization is also nowhere. Lacking a coherent empirical or theoretical underpinning, the concept is in danger of becoming an academic "one-hit-wonder" with little to show for the attention [i] . What does globalization mean? Does it represent a revolutionary change in human history? What can we learn from similar historical phenomena and epochs?

PIIRS Project on Historical Globalization

Project Description

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In that Empire, the craft of Cartography attained such Perfection that the map of a Single Province covered the space of an entire City, and the Map of the Empire itself an entire Province. In the course of Time, these Extensive maps were found somehow wanting, and so the College of Cartographers evolved a Map of the Empire that was of the same Scale as the Empire and that coincided with it point for point.

—Jorge Luis Borges

In historical analysis . . . the long run always wins in the end.

—Fernand Braudel

Introduction

Globalization is everywhere. States, economies, and societies are increasingly integrated; flows of goods, capital, humans, and cultural objects now link us in a global web. There is little doubt that we are undergoing a process of compression of international time and space. Globalization is also nowhere. Lacking a coherent empirical or theoretical underpinning, the concept is in danger of becoming an academic "one-hit-wonder" with little to show for the attention[1]. What does globalization mean? Does it represent a revolutionary change in human history? What can we learn from similar historical phenomena and epochs?

To address those questions, the Princeton Institute for International and Regional Studies (PIIRS) of Princeton University proposes a new way to study globalization and to place it in its appropriate context. The two quotes above suggest the dilemma facing analysts of contemporary global relations. While Braudel advises attention to the *longue durée* and the need to place modern developments in the appropriate historical context, Borges cautions against providing so much background, so much detail, as to create an undiluted portrait of precisely what we are trying to understand. The proposed project will allow for both analytical comprehension without oversimplification and comprehensive accounting without excessive specificity. We propose to foster a better understanding of contemporary reality and the historical process that accounts for it through a collaborative project that will: include cartographic and data-graphic representations of historical transregional flows, produce a succinct analysis of the development of these links over the past five thousand years**.** and promote further systemic study of historical globalization.

[1] For some representative pieces see Mittelman 2000, Hirst and Thompson 1996, Sassen 1991, Castells 1996, and Guillén 2000, Garrett 2000 . The closest we have come to a systemic understanding of globalization is through the World System tradition (Wallerstein 1979, Chase-Dunn and hall 1997, Chase-Dunn and Grimes 1995).

Specifically, PIIRS seeks support for its Project on Historical Globalization (hereafter "the project"), which, as a whole, aims to support collaboration among researchers studying globalization through increasing the availability of data that will facilitate greater interdisciplinary communication. We propose to achieve those ends through two distinct scholarly programs:

1) The International Networks Archive (INA, hereafter "the archive"), a website (www.princeton.edu/~ina) that provides sophisticated interactive capabilities and complete access to the data collected by project researchers. The archive will serve largely as a resource for scholars and advanced students. It will function as a central location for data sets relevant to empirical research on mapping the global web. Through the archive, the data sets can be assembled and standardized so that the various indicators can be combined. The archive, established in 1999, has already collected information covering the past three decades on exchanges by countries, organizations, and individuals throughout the globe. We seek to expand these data sets chronologically and offer mapping and other analytical tools for end users. A central innovation of the project is the simultaneous availability of data and representations thereof, as well as mechanisms that allow for the use of network analysis and mapping techniques on a custom basis.

2) *The Historical Atlas of Globalization* (hereafter "the atlas"), a stand-alone product providing a thorough and graphically exciting overview of the materials gathered. The book that will feature roughly 200 four-color maps generated through INA data. Each two-page plate will include: (a) a global map giving a context to the specific transaction being described, (b) a more detailed map focusing on the most important areas and connections, and (c) a graphic spotlight on a significant aspect of this transaction (e.g., volume over time). Following a group of maps defined by region or form of transaction, a short essay and suggested bibliography will provide readers with scholarly context. The atlas will serve as a pedagogical tool to introduce and disseminate information to the widest possible audience, an audience that is still extremely book-oriented.

The project combines two critical strategies. First, no single scholar or institution can achieve a truly accurate portrayal of contemporary global transactions due to their complexities. To address the intricacies of both the transactions and their analysis, we propose to assemble a project team comprising an international and multidisciplinary cohort of scholars that is committed to and capable of producing the requisite scholarly mosaic.[2] Second, we recognize that the term "globalization" is fraught with political meaning. Some link it to an imperial neoliberal project; others see it as an inherently critical perspective on a natural evolution. To aid both public and scholarly discussions of the phenomenon, we seek to create an empirical product that will provide solid information and historical and geographical context.

We propose a paradigmatic shift in how both globalization is analyzed and how it fits into a more general history. More specifically, this long-term project will make contributions at the following levels:

[2] The closest model for the aspirations of INA is the human genome project and its successful efforts to unite a scientific community behind an empirical target. For the PIIRS project, relevant models are the Interactive Mediterranean Project at UNC (http://iam.classics.unc.edu) and the resulting *Barrington Atlas of the Greek and Roman World*.

1. It will collect data from scholars and provide critical support for broad-based investigations into one of the most important social phenomena of the twenty-first century, globalization.
2. It will create Web-based, data-archiving systems that will enable worldwide access to databases on which the atlas will be based.
3. It will facilitate intensive cross-fertilization of research ideas and projects among selected researchers of diverse backgrounds, disciplines, and interests.
4. It will publish a printed atlas that will provide a coherent and concise summary of changes in global connections across the past ten millennia and allow for a better analysis of what can often be a confused and disordered jumble of transactions.

Why such a project? The new communication technologies provide opportunities that were largely unimagined by earlier cartographies. The Internet frees us from the constraints placed on both libraries and paper publications. The audience for our archive is global. Moreover, by not being limited to a single publication date or even a single product, we will be able to update our data perpetually. With information management techniques, we will also create searchable databases that will allow scholars to create their individualized research projects. Linking these searches to Geographic Information Systems (GIS) technology will permit users to design and draw their own maps. Examples of those maps will be available to future users permitting progressive accumulation of knowledge and analysis. While other sites are available for simple data retrieval on global issues, ours is different in that it focuses on the phenomenon of globalization, provides data on transactions between countries, and allows for graphic manipulation of the data.

But the promise of the project is much more than a technological innovation. How does our printed atlas differ from excellent efforts such as *The Times Atlas of World History* (1993) and Oxford University Press's *Atlas of World History* (1999)? Our atlas will be the first to focus on globalization as an important way of looking at world history. With the volume, we hope to make clearer the substantive improvements our archive will make to a greater understanding of the past. Despite the new attention to world history over the past two decades, approaches to global geographic remain mired in sometimes outdated misconceptions. Ever since McNeill's *Rise of the West*, historians have come to appreciate more and more the critical role played by connections, diffusions, and interactions between different parts of the world. It is no longer enough to tell the story of everything (or alternatively, to define a teleological structure). Rather, world history has more recently attempted to define the "global web" of various periods, to place locales within this web, and to determine how this position and its accompanying interactions produced the next historical stages.[3] By focusing on the interaction between locales, societies, and nations we can provide a better understanding of how global integration has developed over the past five millennia.

This proposal outlines the importance of this area of research in the social sciences, the educational benefits of the project, the specifics concerning the administration of the archive, and a list of existing projects already affiliated with the project.

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[3] For discussions see Bentley 1996, 1997; Manning 1996; Geyer and Bright 1995; and Hodgson 1993. Some recent example of this type of work include Crosby 1986; Wolf 1982; McNeill and McNeill 2003; Bentley 1993; Curtin 2000, 1984; Pomerantz and Topik 1999; and Tignor et al. 2001. For excellent examples of a historical approach to globalization, see O'Rourke and Williamson 2001 and Bordo, Taylor and Williamson, 2003. For a critical perspective on globalization from a historian see Cooper 2001.

Scholarly and Educational Motivation

A major obstacle to our understanding of globalization has been that theoretical treatments have raced far past empirical evidence. Key distinctions between globalization and internationalization, for example, lack a concrete basis. Despite the ubiquity of the term globalization, we have remarkably little data on increasing international integration. Specifically, we lack a systemic capacity to compare the current process of globalization with previous periods of greater or lesser integration. Moreover, we lack the capacity to determine how the structure of participation in this global net affects and helps determine political, economic, or cultural outcomes.

The limited empirical work that has been done to date shares a series of common faults.[4] First, few projects have actually studied globalization as a phenomenon in itself. Second, analyses of international integration have often been limited to the OECD or to large regional groups. The specific relationships between countries *across the globe* remain under-studied. Similarly, attention has focused on contemporary developments with limited efforts to compare them with previous stages of international integration. Thus, the study of globalization has attempted to explore this phenomenon outside of its geographical and historical context. Third, most research has focused on a single form of integration. Yet globalization, if it is a significant social phenomenon in its own right, involves much more than the intensification of a single form of exchange. It is the possibility of *interaction* between a variety of interchanges across the globe, the complexity of these interactions, and the density of the ties between previously distant societies that may be truly significant.

To appreciate the particular qualities of globalization, the metaphor of a network may be appropriate. Most literally, networks are arrangements of connections into nets, or openwork systems linking groups of points and intersecting lines. Obvious examples are the body's circulatory network of veins or a country's arteries of rivers, canals, railways, and roads. Networks may also be interconnected chains or systems of immaterial things, events, or processes. A focus on networks allows us to examine the integration of economic, social, political, and cultural regimes as a process in and of itself. Viewing globalization as a network allows us to combine different forms of interaction (e.g., trade, migration, conflict) into a cohesive portrait of international integration. Finally, network methods operate under the assumption that structural position and associated characteristics are determinant, allowing for a clearer analysis of the consequences of globalization for individual societies over and above endogenous factors.

Yet, network analysts confront some difficulties in communicating their approaches and findings.[5] Operating in a multidimensional causal universe, network models often are reduced to abstract measures of centrality or require an intensive familiarity with sophisticated methods.

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[4] See Clark 1998; Robinson 1996; Huntington 1996; Scholte 1997; Epstein, Crotty, and Kelly, 1996; Rodrik 1997; Carnoy et al. 1993; Fligstein 1998; Gereffi and Hempel 1996; Hargattai and Centeno 2001; Hirst and Thompson 1997; Louch et al. 1999; Smith and White 1992; Gereffi and Korzeniewicz 1994; van Bergeijk and Mensink 1997; Meyer, et al. 1997; Keck and Sikkink 1998; Schwartzman 1998; and Sassen 1999.

[5] For a delightful exception, see Watts 2002. See also http://www.theyrule.net. Critical references in the network tradition include Burt 1980; Breiger 1981; Emirbayer and Goodwin 1994; Gould 1991; Granovetter 1995; Padgett and Ansel 1993; and Powell 1990.

Defining the underlying geography of globalization offers a potential and perhaps clearer alternative as it serves as a common denominator across periods and forms of transactions, and arguably it plays a defining role in the shaping of these relationships.

Mapping offers a possible solution to the dilemmas posed by the complexity of both network analysis and globalization. The tradition of data mapping has been popularized through Edward Tufte's beautiful books (e.g., *The Visual Display of Quantitative Information,* 1983). Interestingly, many accounts of earlier periods of globalization relied on such devices; there is a long tradition of using maps to tell a multilayered story encompassing time and space, exemplified by the work of Charles Joseph Minard.[6]

Maps are far from neutral representations of a reality.[7] In fact, our understanding of globalization is shaped by the cartographic politics and conventions that define our image of the globe. But mapping has the advantage of requiring an explicit definition of geographical limits, foci, and units of analysis. With the development of computer graphics and GIS technology, the advantages of maps can be expanded through the addition of data layers that allow ever increasing levels of complexity. Despite the epistemological dangers inherent in mapping, no other technique so effectively and efficiently captures masses of data and relational positions.

Explicitly recognizing the active intervention of our project, we propose to remap the world and shift our geographical understanding from one dominated by geographical and political parameters to one defined by transactions and networks. By providing a multimap history of globalization, this project explicitly hopes to redefine our conception of this phenomenon and its future. The atlas and the archive will provide a coherent and analytical means with which to explore the development and structure of globalization. It will serve as an "instrument for reasoning about quantitative information."[8]

While we possess some information on the growth of exchanges and transfers for some items between certain actors, we have little comprehensive information on how far the web extends, what is being exchanged and transferred, and to which actors the web extends. We also know very little about how the situation has changed over world history. The project is thus guided by a set of empirical questions reflecting a set of theoretical interests. What is the shape and structure of the global web? To what extent has the shape of the global web changed over time? Are there cyclical patterns in these transformations? Have the number and variety of participants changed? Can we

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[6] For illustrations of some graphic principles, see http://www.math.yorku.ca/SCS/Gallery/historical.html.

[7] See the discussion in Black 1997, and Lewis and Wigen 1997.

[8] Tufte 2001, 10. There are already some related efforts available on the Internet. In terms of variety, the Cartography Department of the Sciences Po in Paris is perhaps the most impressive (http://www.sciences-po.fr/cartographie). INA differs from this effort in making more explicit a network model and by allowing access to the relevant data. Lothar Krempel and his colleagues have focused more on representations of networks, specifically those involved in global trade (http://www.mpi-fg-koeln.mpg.de/~lk/netvis/trade/WorldTrade.html). While these graphics may be the best representations of the networks underlying globalization, they suffer from the unavailability of data and from the exclusion of much of the world not relevant to global manufacture. Other relevant sites include http://www.lboro.ac.uk/gawc/links.html and http://www.iscgm.org.

define the major actors in such a changing web over time? How has the nature of the transported units changed over time? Can we identify a set of structures associated with the dominance of this global web? Do all empires look alike at the network-structural level? If yes, what are the patterns of rise and fall of such structures? If not, how have these evolved across time?

While the major goal of this part of the project is to gather and present data, we are also driven by some theoretical concerns. Rather than formal hypotheses to be tested, these are well-informed conjectures for which we seek confirmation.

1. If scales are defined as consisting of both the size and velocity of transactions, we believe that the integration of various parts of the world has occurred in a series of asymmetrical cycles.
2. Within these cycles, patterns of increasingly complex interaction between the various forms of transactions (e.g. trade, telecommunications, and travel) remain little understood.
3. The contemporary world now exchanges, travels, and communicates on an unprecedented scale. Yet a constant and perhaps increasing share of these transactions is concentrated in the OECD and among the elite of the rest of the world. The United States occupies a central position in almost all global networks.
4. This is not the first time the globe has been so connected or that a single power has played a central role. Whether Rome in the early Christian era, China in the fourteenth century, or Britain in the eighteenth and nineteenth centuries, empires have served as the central node of international transactions on a regional if not a global level.
5. The focal point of globalization shifts from the Mediterranean to the Indian Ocean, westward to the Atlantic, and further on to the Pacific. The commodities that serve as the linchpin of the system have also changed from wheat to sugar and slaves to oil and cash.
6. Despite significant differences, these stages of global interaction share a network structure that serves to create, change, foster, and eventually challenge them. Each of these periods and the systems has been characterized by a pattern resembling the spokes of a wheel, with each historical empire at the center and the various provinces barely attached to each other except through their connection to the center. Alternatively, as suggested by one of the readers for PUP, global networks may better resemble a set of gears, each with a central axis, but interconnected at peripheries.
7. In analyzing the international structure of any era, close attention must be paid to historical legacies which may explain the existence on apparently non-functional or non-optimal connections (e.g. with ex-colonial powers).

If confirmed, these findings would have significant theoretical implications. First, the rules of the *longue durée* of international transaction remain constant even as the scope, scale, and intensity of these transformations increase. Second, a centripetal force pulls exchanges and transactions to a centralizing pattern. While we might expect integration to produce a multipolar world, it may actually contribute to the elevation of a single hegemon. Conversely, we may find that such increases in integration occur only under hegemonic authorities.

In addition to its value as a research tool, the atlas and its underlying archive will serve as a pedagogical resource for teaching about globalization at many levels. While intended for use by scholars, our primary audience is broader and includes students and the non-university public. For this constituency, the atlas will serve as an introduction to the contemporary structures of globalization while also giving a bird's-eye view of historical developments in international integration and diffusion. The atlas and its underlying archive will also serve as a pedagogical resource for those wishing to teach classes on globalization. The atlas will be a popularizing tool with which to make broad parts of the population more sophisticated analyzers of current global trends and will also give greater historical and geographical contexts in which to place current events.

The archive will also facilitate hands-on learning for students by supplying much needed global-scale data. The archive will fill a gap with respect to such educational resources. By presenting network data at a variety of levels, the atlas and archive will contribute resources to a new dimension in network analysis in the classroom. This project will make data available to a much broader group of scholars than the one that is currently working on globalization.

Methods and Content

Obviously, no single individual possesses the expertise to produce even a handful of the maps and databases we have in mind. The core of the project's mission is to coordinate efforts by the appropriate historical, regional and topical experts. As a first stage in the process of finding and contacting such experts, the project named an advisory board to oversee the project. [9] In collaboration with the advisory board, we will be contacting likely candidates to produce the data required, in turn, to generate the maps and databases. Obviously, as we move back in time, the concept of "datum" will need to be stretched. The archive will feature either partial records, or basic scholarly consensus regarding the direction and intensity of connections.

During 2003, PIIRS will make proposals to several foundations requesting research support. We would use resulting funds to sponsor research projects covering our various areas. The largest portion of our requested support will go towards grants to appropriate experts who will be charge of producing the actual data. Researchers donating data sets will be named associates of the project. Upon donating data, they will be asked to sign testaments as to the authorship of the data sets and the rights to control them. The project will fund associates' projects to either improve or create data sets. Funding will be competitive among associates with annual application cycles. The project will nominate a six-person board from the advisory board who will serve a two-year term during which they will not be eligible for archive funding. We will post an announcement calling for proposals in the appropriate websites and journals and will also recruit for particular eras and regions. The board will make the final selections of proposals to be supported**.** Special emphasis will be placed on

[9] Members include Princeton University History, Politics, and Sociology faculty as well key staff from the Library and the Office of Information Technology. External members include Richard Appelbaum (UCSB), Jerry Bentley (Hawaii), Jeremy Black (Exeter), Manuel Castells (UC Berkeley), Christopher Chase-Dunn (UC Riverside), Saskia Sassen (Chicago), and Charles Tilly (Columbia).

supporting graduate student involvement as well as the participation of underrepresented groups and researchers from institutions without significant research funds.

Archiving Data

In the first stage of the project, most of our attention will focus on the archive and on gathering and cataloguing data and interacting with our virtual public to produce some preliminary maps. To assure the most efficient use of the information, data will be catalogued according to several criteria (e.g., author, countries, variables, years). As is standard, we will document all databases with the standard metadata information. Once complete, data sets will be able to provide users with at least four types of information:

1) Distribution of geographical points of origins and destination as well as the distribution of requested attributes.
2) Exchanges between points by time and form of transaction.
3) Topology of exchange networks as well as other bounded objects (e.g. nation states).
4) Maps and graphics with differing layers of temporal frames, periods, degrees of resolution, and synchronic layers.

A version of the website is already developed and provides data on contemporary globalization (www.princeton.edu/~ina). Some data is now available in a fairly primitive format or through a bibliographic links index. During the fall of 2003, we will begin to transform our data and that available in other sites into ArcSDE databases. Those modifications will help determine how the database should be formatted to support interactive mapping, and how existing data structures can be imported into ESRI software. We expect that the resulting data sets will have three different "genres" of information: locations, objects of transaction, and time of transaction. The purpose of this stage is to make the collection searchable, retrievable, and updatable by students and external users. We will then proceed to standardize each dataset. Part of the tasks of the advisory board will be to select a minimal, common unit of data, such as the city, to allow for easier analysis later on. The model may or may not have to be GIS compliant. As we proceed, we will then add a generic mapping utility and provide tools to analyze and visualize the data set mathematically. We will then install some of the data (probably the section on international telephony) as an ArcSDE database on a separate server. We will then explore the ArcSDE data visually to determine how best to display the information. For example, it may be misleading to display two-way telephone service as a series of lines connecting points. Countries shaded by their level of traffic with another country might be a better option. It will also be preferable to make scale-dependent symbol sets of each data layer so more detailed data are visible only at larger "zoomed-in" scales. Next, we will create one or more ArcIMS MapServices to make the information visible to web designers. Finally we will use HTML, Javascript, ArcXML and other tools to create web sites that use the MapServices. The sites will allow those unfamiliar with GIS to use maps to explore the telephone-traffic information. Fortunately, Princeton already has the necessary software to support the project, and we have or will soon have the training necessary to develop the applications. Once this preliminary work is done, we will apply the same techniques to other data categories in the archive.

Displaying Data

We have also been working on the structure of the website as a whole and the generation of some sample maps based on contemporary data. To give an idea of what the final INA online mapping system might look like, we are developing a sample web interface for interactive mapping http://www.princeton.edu/~ina/interactive_maps/index.html, and http://gisserver.princeton.edu/website/miguel21, examples of the kinds of graphics that the archive might produce http://www.princeton.edu/~ina/infographics/index.html, and short presentation on relevant themes http://www.princeton.edu/~ina/thematic_presentations/index.html. (Note that these require or are better viewed with Internet Explorer).

At its first meeting in April 2003, the advisory board discussed problems inherent to mapping. We will need to make choices regarding representation of the flows. For example, we may wish to illustrate the velocity or ease of flows depending on the technology available and the complexity of accomplishing such. We will need to determine if we wish to maintain a single global view or if we can focus on particular areas. Place names have changed and even the geographical meaning of the same names may also change; geographical nomenclature is far from neutral and often carries significant historical and political connotations. We, therefore, will need to construct a "historical gazetteer" that will reference across epochs. To the extent possible, we are committed to producing a multicultural and multilinguistic set of representations.

The dilemma caused by the contradiction between precision and parsimony haunts all scientific enterprise. As the project proceeds, we will need to make many decisions regarding what to map and in what detail; we will need to distinguish between data that have nothing to do with globalization and that which are relevant to the project.

The following general guidelines will define the earliest stages of the atlas:

1. While the project will seek to create new data sets, our major emphasis will be on gathering and organizing already existing information.
2. While the heart of the project will be quantitative information, we also will need to highlight qualitative or episodic elements in this history of globalization. One obvious example is the fall of two cities, Constantinople and Tenochtitlán, which heralded a radical shift in the direction of European trade and conquest.
3. Where quantitative information on a phenomenon is not accessible, we will first make available whatever partial data is available. When mapping such phenomena, we will be guided by expert advice on the historical consensus.
4. We are wary of an inherent Eurocentric and modernistic bias in the selection of data and maps. Such bias may be due simply to data availability, it but could also stem from the makeup of the board. Possible s s may include an emphasis on pre-sixteenth century developments, a conscious effort to explore what is going on outside the "usual suspects" of globalization, and, most importantly, a broader recruiting effort for our associated scholars.
5. We will need to distinguish between the process of globalization and its product. Similarly, we must distinguish between flows and resulting stocks, between incidence and infection. A ance, then, must be struck between maps that focus on transactions in

and of themselves and those that address the results of transactions. We may, for example, wish not only to document the flow of the materials and technologies needed to make a factory, but also to present a count of factory locations at particular moments in time.

6. The multinodal flow of influences and transactions must be recognized. No matter how asymmetrical these may appear, the interaction between the different flows and the directions thereof makes globalization worth studying in and of itself.
7. Methods and visualizations that can take into account both geography and chronology must be developed. Possible ways of categorizing the different forms of interaction include:
   a. the structures along which interactions take place; the natural and fabricated geography of globalization;
   b. the machines that fuel the interaction, or the means through which this integration takes place: transport and communications systems;
   c. the processes involved in the interaction, or the actual forms of interaction: trade, invasion, and migration;
   d. the content of integration: goods, services, ideas, and people; and
   e. the network of interactions themselves or the resulting pattern of interactions.

Mapping Historical Globalization

With these issues in mind, we propose the following, nonexhaustive list of maps. Note that there may be significant redundancy across some of the maps as we will sometimes be using the same data to indicate different processes. Railroads and air links, for example, are simultaneously the product of globalization, the carriers of globalized products, and the symbols of a new international integration and will thus be represented on those maps and perhaps others.

Geology: We will begin with relief maps of the basic geographical terrain with special attention to significant geological shifts from volcanic explosions to silting of ports. A map of temperature zones (and shifts therein) will accompany this section. Given the critical importance of water navigation, we will also include a map of the major wind currents as well as indications of the direction and navigability of river flows. Finally we will include a series of maps indicating deposits of critical minerals for different time periods (e.g., copper in the second millennia BCE, oil in the twentieth century).

Fauna and Flora: Using archeological and historical sources, we will map the availability of different animals and agricultural goods in different periods. We will also include maps of the diffusion of such resources. Candidates for mapping include the diffusion of major cereals and other foodstuffs and the transfer of animal stocks (and their elimination).

Transport and Communications: Depending on the period and the relevant technology, we will provide maps of transport routes (caravans, sailings, roads, railroads, air links). A connected set of maps will produce indications of the time of travel and associated costs. A similar set of maps will provide equivalent information for various forms of communications. Examples of these would include a map of major monsoon-driven routes, mountain crossings, the Silk Road(s), and contemporary transport systems.

Empires: These maps will be similar to the standard offering in historical atlases. A series of maps will document the creation and dissolution of empires that have played a significant role in global integration. These include the Macedonian, Roman, Chinese, Arab, Mongol, Spanish, and nineteenth-century European empires.

Wisdom and Health: Since the first centuries of the Common Era, various sites have played a critical role in defining and diffusing scientific and artistic knowledge. Cambridge, Constantinople, Cordoba, Cairo, and Chicago have served as the centers of a global network of experts and adherents. We will map these links and the transitions from one era's scientific capitals to others. Examples will include leading universities, flows of international students, major hospitals, contemporary medical tourism, flows of pharmaceuticals, and the establishment of leading museums and the flow of art to and from them.

Services and Factories: Urban centers have also served to provide provisions for markets of goods and services. These "middle-urbs" have served as key nodes in global exchanges. We will map those major markets as well as more contemporary versions such as leading stock markets and the headquarters of global firms. A parallel set of maps will display central production sites in global commerce. Examples would include offices of early banking houses and more contemporary groups such as American Express and McKinsey Consultants as well as the manufacturing locations of critical manufacturing inputs (from looms to transistors).

High-value/Prestige Goods: Certainly during earlier stages of global trade, luxury goods led the development of exchange networks. In some cases, these still represent important parts of global trade, particularly in the case of the illegal drug trade. We will map exchanges in such goods as obsidian, gold, silver, gems, feathers, spices, and cocaine. Maps will offer information on creation/manufacture, transport, and consumption.

Low-value/Bulk Goods: Such goods are important in defining the effects of globalization on the mass population. Perhaps the first elaborate exchange network was in tin and copper (ingredients for bronze). Bulk food goods such as wheat/maize/rice also developed early. More recently, industrial commodities (as well as foodstuffs) have become predominant. The choice of which goods to map will be partly driven by historical significance (e.g., cotton) and by theavailability of data.

Manufactured Goods: At different stages, various forms of manufacture have been central to global trade. In the earliest form of a trade network, weapons were perhaps the most critical good (and the arms trade remains an important part of world trade). Later, textiles were central but were then supplanted by heavier industries and capital goods. The two most important contemporary exchange networks are in electronic goods and automobiles. For the latter, we will create maps detailing the international integration of production.

Coinage, Investment, and Capital Flows: Trade has often benefited from the creation of a global currency standard accepted across a variety of regions. International transactions would be practically impossible without such accepted tender. We will map several examples, including Roman coins, Spanish silver pesos, British pounds, and American dollars. We will also attempt to map the

earliest incidence of institutions such as letters of credit. Foreign investments and lending are almost as old as trade in actual goods. We will map "capital centers" for different eras as well the general flow, direction, and forms of financial resources.

Mass Migration: Beginning with the initial move north and east from Africa, global history has been shaped by mass migrations. In the first set of maps in this category, we will track prehistorical mass migrations through recent research using DNA mutations. We will then concentrate on several specific examples, including the Indo-European invasion and that of the "barbarians" into Europe around 300–500 CE, the flows of migrations into South Asian, the "Hansization" of China, and the predominance of Bantu groups in sub-Saharan Africa. Another set of maps will concentrate on the peopling of the Americas and the Pacific. A final group will look at the special case of historical and contemporary nomadism.

Ethnic and Political Diasporas: This section will include maps of ethnic-specific migrations, such as the Jewish, Chinese, Indian, Lebanese, and Armenian exoduses. A related group of maps will focus on the great migrations across the Atlantic and Pacific in the nineteenth and twentieth centuries. Another set will concentrate on flights from political and religious persecution that have had a significant effect on global developments. Some of the latter include the Protestant expulsions and migrations in the seventeenth to eighteenth centuries, the intellectual exile from Nazi Germany, and more contemporary examples such as Soviet *refuseniks*, and Cuban and Chilean exiles.

Slavery: This set of maps will concentrate on forced migrations with special attention devoted to both East and West African slave trades. We will also look at the special case of the Ottoman Empire. Contemporary maps will focus on a wider array of forced migration with special attention to the flow of sexual labor.

Free Labor and Travel: The free movement of labor is a relatively new phenomenon, and these maps will therefore concentrate on contemporary labor flows. A parallel set of maps will focus on the creation of contemporary tourism. Examples will include the network of Filipino guest workers, the labor markets of the oil-rich Middle East, the postcolonial movements to Europe, and the special case of the Rio Grande frontier. On tourism, we will identify macro flows to global sites and the location such institutions as Club Meds and amusement parks.

Diseases: The transmission of diseases has been one of the most obvious examples of globalization. We will examine only those with major historical impact such as the sixth- to seventh-century plagues, the Black Death, the "American Genocide" of the sixteenth and seventeenth centuries, cholera, influenza, as well as more recent examples such as Aids and SARS. We may also wish to map other health-related diffusions including obesity and antismoking legislation.

Conquests and Wars: This set of maps will analyze the expansion outside centers of military power and pay special attention to the creation and development of frontier zones. As with the maps of empires, this section will look very much like a standard historical atlas. More contemporary maps will also include peacekeeping and forward deployments of units.

Religions: This section will map the expansion of major global religions with special attention to missionary movements and the creations of "conversion frontiers." It will also include maps that

represent the diffusion of foundational texts (translations, publishing, etc.) and trace major pilgrimage sites from Mecca to Compostela.

Languages: The maps in this segment will begin with the initial appearance of writing systems and then proceed to the diffusion of alphabets and writing (and printing) technology. Some will depict shifts in global distribution of languages and the creation of "world languages."

Aesthetics: This section will map the spread of literary and artistic styles across the globe, including architectural developments, musical styles, and mass media. Examples include Greek amphitheatres, Hindu and Buddhist temples, the development of Gothic and Baroque styles, the diffusion of Islamic art forms, the globalization of opera in the nineteenth century, and the "Americanization" of mass media.

Politics and Policies: These maps will track the diffusion of ways of seeing and understanding the material world as well as prescriptive strategies. Candidates include the Communist International, Islamic fundamentalism, contemporary neoliberalism, environmental protection regulations, new global jurisdictions, and extradition treaties.

Animals, Steam, and Nukes: These maps will show the distribution of animals and appropriate technologies for transport and agriculture. We will pay special attention to how the diffusion of these resources and technologies makes integration possible.

Technology: This section will map the diffusion of certain techniques and forms of engineering knowledge. It will include maps on navigation and production technologies (e.g., sailing ships, the compass). A subsection will map differing travel times and connectivity between critical parts of the globe.

Weapons: Beginning with the chariot through the development of tanks and missiles, weapons have been at the forefront of technological and political diffusions. This set of maps will document the process across the millennia.

Cultural Carriers: Beginning with the diffusion of writing, particular forms of expression have carried ideas across the globe. We will give particular attention to contemporary technologies, such as newspapers and television.

Consumption Centers: Markets and locales where new consumer goods become available also serve to diffuse global cultures. Early examples might include monasteries and the publication of special texts. We will pay special attention to central markets and, in more contemporary times, global chains (e.g., Gap) as well as ethnic restaurants. For the modern period, we will focus on the penetration of information sources such as CNN and the *Wall Street Journal*, as well as media in opposition to these trends.

Maps of Networks: This set of maps will provide a summary of the connections described above. A subset on power configurations will feature informal empires and alliance systems, such as those seen during the Reformation, the Anglo-French wars, and the cold war. A section on commodity chains will describe global assembly lines and marketing systems. Another set on trade cycles will

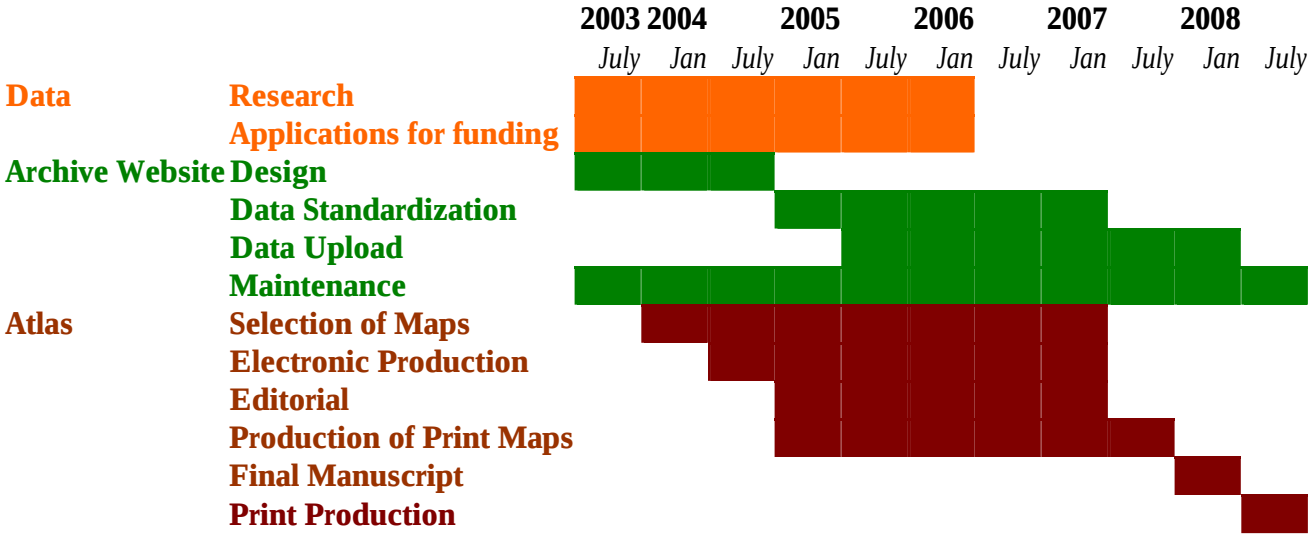
describe links between production and exchanges across the globe. Another on cultural zones will define areas interlinked by a series of exchanges and the diffusion of cultural standards and norms. A set on technological grids will focus on telephone, telegraph, and Internet connections.

Schedule

The first stage of this project began in 1999 and has already produced papers presented at several professional conferences. One article focusing on telephone communications appeared in the *Washington Quarterly* in spring 1999. In conjunction with several colleagues at other universities, INA also organized a special issue of the *American Behavioral Scientist* on "Mapping Globalization" (July 2001), which has received considerable attention and has been widely cited.

The first meeting of the advisory board was held in Princeton in April of 2003 and produced many of the ideas discussed above. Subcommittees of the board will meet periodically and a full meeting will be held in 2005. We are awaiting a preliminary contract from Princeton University Press for the atlas which has already received three very positive reviews[10]. During the coming year, we will focus on contacting scholars for possible production of data as well as on applications for funding. The design work on the website will continue. Beginning in 2004, we will begin preparing the data model for all future archive entries and hopefully begin loading the data sets. The selection of maps for the published atlas will begin in 2004 in conjunction with our efforts to recruit scholars. As the data come in and we begin the design process, we will also work on the production techniques and editorial protocols. The archive should be well functioning by 2005 at which point we will also have some map plates ready for inspection. We expect completion publication of the atlas by 2008.

Preliminary Schedule



Site and Personnel

[10] These have given the Press permission to provide their names: John Campbell (Dartmouth), J.R. McNeill (Georgetown), and Kenneth Pomerantz, UC Irvine).

Princeton University is uniquely qualified to host this project. The University has provided the startup funds for the project and has made available considerable overhead support. The University will continue to do so in conjunction with the new Princeton Institute for International and Regional Studies. PIIRS will house all personnel associated with the project. The University's Social Science Reference Center at Firestone Library, the Academic Services unit of the Princeton Office of Information Technology, and the Educational Technologies Center are currently assisting in the further development of the archive and will also participate in the preparation of the atlas.

The P.I., Miguel Centeno, possesses the scholarly and editing experience to guide the project. He has managed several organizations, has produced several academic volumes, and created a six-hour CD-ROM based on his course on "The Western Way of War." He has also managed the INA website for the past three years.

The project also has an advisory board. Roughly half of the project's advisory board consists of Princeton University faculty and staff, and the other half, an international group of scholars. As currently constituted, the board is U.S.-dominated with a small European presence, but we will seek to broaden representation (see footnote #9).

The project will also hire a Publication Project Manager and a Website/Database Manager. Each of these two half-time positions will be responsible for the production of the atlas and the archive respectively. For the first, we will seek a publishing expert with considerable editing experience. For the second, we will look for someone familiar with both GIS and database design. At critical points in the project, we will also hire more experienced technical consultants to oversee the development of the website. Once we have begun to receive historical data, we will also hire someone with mapmaking experience (in conjunction with the likely publishers of the atlas, Princeton University Press). Finally, we will be hiring undergraduate and graduate students to assist with the functioning of the project's offices and with the processing of data as it becomes available.

Budget

We are requesting $1,283,945 over five years. Nearly half of these funds will be used to support direct research by archive associates and will result in data for the archive and maps for the atlas. The other half will be used for technical and support personnel at the INA office in Princeton. None of the requested funds are intended to supplement or replace the salaries of any of the academic investigators involved.

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The problem of sustainable urbanization is crucial for the human encounter with the consequences of our ballooning environmental footprint. Over half of the human population of the Earth now lives in very large cities, and these have spread rapidly over the land as population densities within cities have decreased and cities have spread into huge city-regions. Our research project is developing a methodology for measuring the rates and the nature of the areal expansion of world cities and the patterns of decreasing population density in order to know whether or not urban sprawl is accelerating or slowing down. We are also studying changes in the world city-size distribution over the past three decades. The system of world cities has been flattening as megacities in the non-core countries have caught up in terms of overall population size with the global cities of the core. We are examining this trend closely to see if it has leveled off or accelerated. And we are studying differences among the cities of the core and the non-core with respect to the rates and nature of urban sprawl and the changing structure of the built environment.

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In 1913 the anthropologist Goldenweiser proposed his “principle of limited possibilities,” noting that once a line of cultural development has begun it develops increasingly massive inertia and becomes very hard to reverse. Despite claims by such scholars as Wallerstein and Taylor that a reversal is on the horizon what we have come to call, on the basis of Wallerstein’s pioneering work, the Modern World-System, a form of societal self-organization based initially on capitalist agriculture, now possesses massive, probably irreversible inertia. In the late 1930s the economist Schumpeter, analyzing Marx’s failure to predict the demise of capitalism, suggested that capitalism periodically renewed itself by “the process of creative destruction.” In 1988 the geographer Hägerstrand proposed the idea of de-novation as a logical corollary to the idea of innovation, suggesting that innovation was only possible in the presence of de-novation. I have argued that innovatory technologies, especially in transportation and communication, have driven successive waves of economic and political development for the past several hundred years of the World-System. If we are to successfully analyze, not just describe, the World-System, two core questions that must be answered by historical macro-social science are where, how, and why de-novation and innovation occur and along what pathways and with what success such forces diffuse. Significant elements of these questions are inherently subject to geographic analysis.

"Technologies and World-Systems: innovation, de-novation, and diffusion as core problems for the social sciences."

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Abstract

In 1913 the anthropologist Goldenweiser proposed his "principle of limited possibilities," noting that once a line of cultural development has begun it develops increasingly massive inertia and becomes very hard to reverse. Despite claims by such scholars as Wallerstein and Taylor that a reversal is on the horizon what we have come to call, on the basis of Wallerstein's pioneering work, the Modern World-System, a form of societal self-organization based initially on capitalist agriculture, now possesses massive, probably irreversible inertia. In the late 1930s the economist Schumpeter, analysing Marx's failure to predict the demise of capitalism, suggested that capitalism periodically renewed itself by "the process of creative destruction." In 1988 the geographer Hägerstrand proposed the idea of de-novation as a logical corollary to the idea of innovation, suggesting that innovation was only possible in the presence of de-novation. I have argued that innovatory technologies, especially in transportation and communication, have driven successive waves of economic and political development for the past several hundred years of the World-System. If we are to successfully analyze, not just describe, the World-System, two core questions that must be answered by historical macro-social science are where, how, and why de-novation and innovation occur and along what pathways and with what success

such forces diffuse. Significant elements of these questions are inherently subject to geographic analysis.

Introduction

In volume three of *Das Kapital* Marx predicted, in his "Law of the Tendency of the Rate of Profit to Fall" (henceforth "Law") what to him seemed the inevitable demise of capitalism (Marx 1959, pp. 211-31). Marx suggested several ways in which capitalism could postpone the inevitable, most of which have been tried, but it fell to Schumpeter in the 1930s to accurately analyse the true reason why capitalism failed to decline, or, rather, why it showed a clear, regular, cyclical pattern of declining followed by rising profits first identified by the Russian economist Kondratiev. Schumpeter was the first to realise that the interests of capitalist investors were not necessarily the same as capitalist entrepreneurs and that all such capitalist interests were linked intimately but differently to technologies. Periods of declining profits in an ageing technology subject to Marx's "Law" were followed by what Schumpeter described as a "process of creative destruction" and the re-investment of capital in new, more profitable technologies (Schumpeter 1976, p. 83). Marx, unable to distinguish between investor and entrepreneur, failed to see that investors had no emotional commitment to a given technology: that their primary, perhaps their only interest, was in the profits that technology returned. Entrepreneurs who had grown up and prospered investing in a given technology, could not always "see" the declining returns on their investment, failed to disinvest, and drove the cyclical crises of capitalism identified by Kondratiev. Schumpeter thus "supplied the missing Marxian connection between the theory of the capitalist cycle and the theory of capitalist crisis, and made the distinction he believed Marx had failed to make, between the capitalist and the entrepreneur" (Hall & Preston 1988, p. 14). Simply put, disinvestment in old and reinvestment in new technologies is the motor of capitalism (Hugill 2003).

In 1913 the anthropologist Goldenweiser proposed his "Principle of Limited Opportunities" (henceforth "Principle"), suggesting that once a culture had embarked on a specific line of development other possible lines of development were choked off and either abandoned or seriously reduced in importance. Cultures thus develop a structural resistance to change. The capitalist world-economy, as described first by Wallerstein (1974), was a new macro-cultural World-System that replaced the first World-System seen on this planet, the world-empire. Tribute-taking world-empires were the over-arching human politico-socio-economic organizational system from their initial development in Mesopotamia until very recently: the former Soviet Union had all the hallmarks of a classic world-empire. As many authors have pointed out, world-empires were inherently unstable structures, prone to serious over-extension and collapse. Although some lasted significant amounts of time, the length of time was fundamentally dictated by the inherent slowness with which any such world-empire could expand when the only land transportation systems were animal or human powered. The most recent attempts at world-empires have fallen as quickly as they expanded.

Feudal Europe was, of course, not a world-empire, and the "crisis of feudalism," severe by 1450, was, as Wallerstein notes "a conjuncture of secular trends, an immediate cyclical crisis, and climatological decline." Out of this complex crisis, part economic, part environmental, came the second macro-cultural World-System, the capitalist world-economy. Wallerstein argues that "three things were essential to the establishment of such a capitalist world-economy: an expansion of the geographical size of the world in question, the development of variegated methods of labor control for different products and different zones of the world-economy, and the creation of relatively strong state machineries in what would become the core-states of this capitalist world-economy. The second and third aspects were dependent in large part on the

success of the first" (Wallerstein 1974, pp. 37-38). No geographical expansion, no capitalist world-economy.

This geographical expansion of the late 1400s was technologically driven at the hardware and software levels: the hardware technology of wind-driven ships capable of open-ocean voyaging, as opposed to the human powered ships used by most world-empires, would not have been successful without the software technologies of reliable systems of navigation and increasingly reliable maps (Hugill 1993). As Wallerstein notes, the emphasis of the world-economy was, from it's beginning, on the movement of bulk agricultural goods and not of preciosities (Wallerstein 1974, p. 41). By Wallerstein's definition, and with apologies to Abu-Lughod (1989) and Chase-Dunn & Hall (1997), the only World-System before the late 1400s took the form of a multiplicity, over historical time, of failed world-empires. In Wallerstein's reading, the massive innovation of the capitalist world-economy could only emerge out of the "crisis of feudalism." Only Sanderson has attempted to address what many scholars have claimed is an argument for European exceptionalism. Sanderson dismisses the claims by many scholars that China was en route to capitalism around 1000 AD but argues that Japan was "essentially capitalist" before 1853 (Sanderson 1999, p. 176). In the event, Japan's indigenous capitalist development was halted when the capitalist World-System that had developed in Europe diffused into Japan after 1853.

The new technologies of open-ocean navigation and shipping made it possible for trade-based systems to start to displace tribute-based systems. New polities began to emerge as some governing elites switched from tribute taking and a tendency to want to themselves monopolise the trades in preciosities to taxing trade and providing transportation infrastructure and military protection for traders. As income from taxes replaced income from tribute this engendered more

and more willingness on the part of governmental elites to encourage a larger and larger merchant class to seek out and develop trading opportunities with decreasing levels of governmental interference.

Trade versus Tribute based Polities

As Tilly has demonstrated there are considerable differences between polities based on trade and those based on tribute. Most of these differences come down to communication technologies. Trade based polities need to manage production at a distance and from very different cultural regions, but are unable to use high levels of coercion because of the difficulty of power projection over space before land transportation systems moved beyond the animate. Trade based polities thus have to depend on rapid and accurate communication, capitalist managerial rather than coercive systems, and co-operative behavior between what are often culturally very different elites (Tilly 1990). Wallerstein notes that capitalist agriculture historically organized labor systems by region within the World-System: whether they were in the core, semi-periphery, or periphery (Wallerstein 1974). Taylor notes that elites practiced trans-regional co-operation, while imposing different labor management systems on different regions (Taylor 1993). The most innovatory software technology of the World-System in its formative period was the shift from co-erced labor systems in the core to free, waged labor.

The history of the World-System over the past five hundred years or so has been the history of the ascendancy of trade as opposed to tribute-based polities. Sanderson's argument about the indigenous development of capitalism in Japan before 1853—and his dismissal of the claims for an earlier, Chinese development—is that "capitalism was born of class struggle. However, it was not, as the Marxists would have it, a struggle between landlords and peasants. Rather, it was the struggle between the landlord class and the merchants" (Sanderson 1999, pp.

175-76). The ascendancy of trade not only saw the ascendancy of the merchant class, but also an ever-increasing emphasis on the transportation of goods and the communication of information and ideas. This has played out in the development of new forms of transportation, initially sea-based, but from the railroad on bringing the advantages of cheap bulk goods movement to land transport.

At the conclusion of his 1974 book in which he introduced the idea of the Modern World-System, Wallerstein suggested that the only alternative to the capitalist world-economy "that could maintain a high level of productivity and change the system of distribution…would [be]…a socialist world government" (Wallerstein 1974, p. 348). Many scholars who have followed Wallerstein have made similar arguments, usually without substance. Taylor, however, argues persuasively that the World-System is now suffering from a building crisis of over-consumption and that the planet simply does not have the resources, especially in energy, for human societies to continue to consume more and more (Taylor 1996). Taylor's preferred solution is the collapse of the capitalist World-System and its replacement by a socialist one. An alternative would be the emergence of technologies of sustainable development.

The Role of Technologies in World-System Change

World-System theory as put forward by Wallerstein is, essentially, descriptive and atheoretical. It has no predictive power since it regards each instance of hegemony as, essentially, unique and Wallerstein gives us no mechanism to drive the shifts of hegemonic power in the World-System that he identifies. In an article Wallerstein does provide a definition of hegemony: the brief overlapping of massive superiority in agro-industrial production, commerce, and finance, but he provides no mechanisms by which such superiority might be achieved (Wallerstein 1984). Kondratiev long-wave theory as adapted by Schumpeter indicates

that technological change drives Kondratiev waves in the world economy, but such waves are only of fifty to fifty-five years in duration. In 1978 Modelski pointed out, if one projects Kondratiev cycles back to the start of the European expansions in the late 1400s, there is a pattern of two Kondratiev cycles combining to create a world leadership cycle (Modelski 1978). In later work he and Thompson suggested that such cycles were marked, if not driven, by the achievement of the hegemon of massive naval superiority (Modelski & Thompson 1988). In 1993 I suggested that Modelski's world-leadership cycles were better understood as driven by the emergence of new technologies of transportation, and in 1999, building on work by Hall & Preston (1988), I deepened that argument to suggest that technologies of communications, especially telecommunications, have been even more important in driving hegemonic shifts because they have operated in a specifically geopolitical context (Hugill 1993, 1999).

Innovation and De-Novation

If new technologies save us from the malignant operation of Marx's "Law" and drive the successive waves of economic and political change in the capitalist World-System, then where, how and why new technologies develop is obviously of central importance to our society. Failure to innovate would, in this model, be the surest way to break through the inertia of the current World-System and bring us to some new and, *pace* Wallerstein *et al*, not necessarily better, over-arching politico-socio-economic organizational system. In 1988 Hägerstrand suggested that innovation could, because of the working of Goldenweiser's "Principle" and the need to break through the inertia found in all operating macro-cultural systems, only occur in the presence of some significant level of de-novation. Once the processes of de-novation and innovation have operated it then becomes important to look at the process of diffusion. Along

what pathways do new technologies and ideas move and by whom and with what success are they adopted?

Although there is a vast academic literature on diffusion there is comparatively little on the nature of innovatory environments and almost none on de-novation. The academic literature on innovation is somewhat contradictory in that the two main theories are more concerned with diffusion than with innovation, they conflict, and neither are well supported by the evidence. One theory, propounded by the *kulturekreis*—culture circles—school, held people to be generally uninventive, innovation to be rare, and diffusion easy, even epidemic in nature. The other, the utopian theory of culture change, held people to be innately and uniformly innovative. Yet diffusion is not epidemic in nature, as Hägerstrand and his students have routinely shown, and innovations cluster in time and, most particularly, in space (Hugill 2003).

Some of the most sophisticated work on where innovation occurs has come from Peter Hall's work on "The City as Innovative Milieu" (Hall 1998, pp. 289-500). Most innovations, especially in the technologies that have driven hegemonic shifts in the World-System, have come from a very small number of city-regions. Hall focuses on six cities and six sets of technologies:

(1) Manchester/cotton textiles

(2) Glasgow/shipbuilding

(3) Berlin/telegraphy, electrical power generation

(4) Detroit/automobiles

(5) Silicon Valley/solid state electronics, computers

(6) Keihin (Tokyo-Kanagawa)/consumer electronics, solid state electronics

Of these, only Manchester's cotton textile technology is not clearly related to transportation or communication technologies. Out of these case studies and a long introductory journey through location theory, "a rather obscure sub-science, existing at the borderline of human geography and economics" (Hall 1998, p. 291) Hall develops two models of innovation, "the freewheeling laissez-faire one…and the state-guided centralized one" (Hall 1998, p. 497). For Hall, neither answers the crucial question of how we might model Kondratiev shifts that depends on "a chain of continuing innovation over decades and even centuries" (Hall 1998, p. 499). The historical record shows that both models have both succeeded and failed at different times and in different places.

I argue elsewhere that Hall shows too much concern here with hardware, material production technologies, and not enough with the software and cultural production technologies that are becoming increasingly important to the profitability of the capitalist World-System (Hugill 2003). Hall does, however, treat cultural innovation somewhat tentatively—"theory almost fails us"—in another section, identifying two more great innovatory centers: Los Angeles for movies and Memphis for rock and roll (Hall 1998, pp. 503-608, quote p. 504). Here communications are again central. What theory Hall does find here emerges not from economics, but from the theory of communications propounded by Harold Innis, that there are space-binding cultures and time-binding cultures and that these are largely a product of interaction between their communications media and their macro-cultural goals (Innis 1950, 1951). In terms of more recent intellectual discourse these roughly approximate the trading states and territorial states proposed in rudimentary form by Mackinder (1919), more completely by Fox (1970) and most thoroughly by Tilly (1990). Although Hall fails to make the connection

the link between technology and state type through communication is both inherent in the work of Innis and inescapable (Hugill 1999).

We thus need a more complete theory if innovation, one that includes at least cultural and material production and hardware and software technologies. Hall's theory of the innovative milieu is an excellent place to start, if incomplete because it signally fails to merge cultural and material production in a single model. Hall approaches, but does not quite solve the problem, when he argues that the innovative milieu of the six industrial cities he examines was often formed in small workshops rather than great factories. The great factories of Arkwright in the first industrial revolution and Ford in the second were primarily solutions to the inherently geographic problems posed by inadequate transportation systems: the geographic complexity of the putting-out system before 1770 and the physical impossibility of overseeing small units of labor at many dispersed sites of production; and the impossibility, given the transportation infrastructure and technology of the 1920s of implementing "just-in-time" production as Ford wanted to—his Highland Park factory had worked well that way, but the scale jump to real mass production in his Dearborn plant rendered it impossible.

It was left to Toyota to reintroduce "just-in-time" production and take credit for it and for companies such as Wal-Mart to bring it into the sales arena. The main structural advantage of a "just-in-time" system is that it maximizes two sorts of scale advantage. On the one hand it supports the economies of scale only large factory units enjoy. On the other it allows, in the workshops that support the large factories, the maximum number of innovatory experiments. Workshops are, however, sites of artisanal as well as industrial production, and artisanal production has a strong link to modes of cultural production: it is not merely about the mass production of the largest number of units at the lowest price, but also about artistic design and

pride of workmanship. It thrives best in sites of artistic production. Although Hall treats Los Angeles almost entirely as a center of movie production it is important to remember that Los Angeles has always made a larger contribution to automobile design than has Detroit. Harley Earl, later to head up General Motors' design team and create annual model changes based purely on appearance, started out customizing cars for movie stars in the teens and twenties. The traditional hot rodding of the 1940s on, no less than today's "tuner car" culture, is a quintessentially Angeleno phenomenon, developed in hundreds of independent workshops, the products of which meet weekly on the formal race tracks and nightly on the streets of Los Angeles, and which massively influence the broader American car culture. Many major car companies keep Los Angeles area design bureaus to tap into the constant flow of stylistic as well as technical innovation the region produces. Such synergy between cultural and material production must be part of a broader model of innovation.

But what of innovation's darker side, de-novation? Capitalist polities have been most reluctant to embrace Schumpeter's "process of creative destruction." Thus far only Thatcherite Britain and Reaganite America seem to have accepted that the destruction of jobs is as important as the creation of new ones, since new ones are unlikely to appear without massive disinvestment in old and reinvestment in new technologies, and even they have scarcely been purist, as witness the current American government's shoring up of textile and steel industries. Other capitalist polities, perhaps with worse memories of the consequences of the economic collapse of the 1930s, have maintained high levels of state spending on old technologies apparently regardless of costs. Clearly de-novation must be at least not demonized, if not actively encouraged. Clearly there must also be a societal "safety net:" re-education programs for those who wish to embrace new technologies; some level of welfare for those who cannot be re-educated.

If I return to Hall's central question of where something happens, where de-novation occurs is a much harder problem than where innovation occurs. Some cases are clear, but not necessarily helpful. Oldham, Lancashire, was once the greatest cotton textile weaving city on the planet for most of the 1800s and early 1900s: today, the square mile of "weaver's triangle" where nearly all those weaving sheds stood is open parkland. With few exceptions, nearly all of Detroit's pioneering automobile plants have been razed along with vast acreages of the housing for their workers. If Manchester (or Oldham) and Detroit once represented innovation and industrialization on a truly heroic scale they now represent de-novation and deindustrialization on the same truly heroic scale. Scale must count for something here. De-novation perhaps works well only at the workshop level, where comparatively few people are involved, disinvestments costs are low, and a rapid shift to an innovatory technologies is easier.

Diffusion

Finally I turn briefly to diffusion, not because it is of any less interest or importance than innovation and de-novation, but because it is academic ground well turned and cultivated. From the point of view of what matters most to the continued health of the capitalist World-System, however, the diffusion of technology is far less important than innovation or de-novation. Neither the *kulturekreis* model of epidemic diffusion nor the utopian model of universal innovation where diffusion would be irrelevant works in practice. A simple question, "where does innovation occur?" gives a simple answer: "only in rather special innovation milieus." For this reason diffusion of innovations is important. Our very considerable literature on diffusion suggests that it works well within a given culture, or between cultures with certain common values, but with great difficulty or not at all between markedly unlike cultures. Hardware technologies diffuse with relative ease, although the technologies needed to replicate

technologies may not. Software technologies often diffuse with great difficulty. For example, hardware technologies based on such technologies as internal combustion engines, electricity, and organic chemicals diffused rapidly within the core of the capitalist World-System as it existed in 1900. By the end of the first German War, America, Britain, Germany, and Japan were all capable of building massive battleships, automotive tanks, airplanes, wireless communications systems, and manufacturing dyestuffs and explosives based on organic chemistry. The American software revolution of more efficient production pioneered by such as Ford, Gilbreth, and Taylor diffused only very slowly and with great difficulty, yet it was to prove the compelling advantage in terms of organizing industrial production for the second German War, and one of the principal reasons for American hegemony thereafter. Yet no one sought to hide what was happening. Ford welcomed visitors to his assembly plants and exported whole plants to Britain, France, Germany, Japan, and the Soviet Union in the inter-war period. Gilbreth (1911) and Taylor (1911) both published extensively on their management technologies and actively promoted them outside as well as inside America. Yet only after the German Wars were over did the rest of the world fully embrace the software revolutions pioneered in America before the first of those wars.

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This research examines the changing relationships between economic space and geographic space over the past thirty years as a result of the global dispersion of production and the expansion of transnational corporations, a process commonly referred to as “globalization”. We study a hypothesized de-coupling of economic and geographic space by examining the growth of transnational interlocking corporate directorates from 1970 to 2000, utilizing a new spatial analysis technique referred to as “geographically weighted regression”. This methodology will enable us to quantify the extent to which this separation has occurred as well as its regional differences and the factors that correlate with these differences.

The Impact of Globalization on the Changing Relationships Between Geographic and Economic Space: A geographically weighted regression analysis of global interlocking corporate directorates 1970 - 2000

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Abstract

This research examines the changing relationships between economic space and geographic space over the past thirty years as a result of the global dispersion of production and the expansion of transnational corporations, a process commonly referred to as “globalization”. We study a hypothesized de-coupling of economic and geographic space by examining the growth of transnational interlocking corporate directorates from 1970 to 2000, utilizing a new spatial analysis technique referred to as “geographically weighted regression”. This methodology will enable us to quantify the extent to which this separation has occurred as well as its regional differences and the factors that correlate with these differences.

Introduction

Historically, economic activity has been tied to geographic location. This is a relationship that emerged around 1000 AD, as political-military organizations (empires, monarchies, fiefdoms) absorbed autonomous cities, which were the centers of economic activity into their geographic territory. This geographic merger of military and economic activities resulted in the modern global inter-state system that delineates the physical boundaries of our world today (Tilly 1994). Over the past twenty years, however, this merger of geographic and economic space has begun to fracture. Economic activity is increasingly transnational in scope, which allows it to separate from the geographic (and political) space within which it was previously bound. This globalization of economic activity has been fueled by the global dispersion of production that began in the 1980s, as corporations shifted their manufacturing facilities to areas with lower cost labor, weaker environmental regulations and abundant raw materials (Sassen 1991). Low cost transportation, cheap wages, and high-tech telecommunications systems have made the relationships between geographic space and economic activity increasingly complex. For example, autos sold in any given country are no longer manufactured there. Individual components are manufactured in a multitude of countries, shipped to another country for assembly, and reshipped to its final market for sale. It has also become increasingly difficult for individual nation-states to regulate these global economic processes. Transnational corporations now have the ability to move capital and facilities wherever it best suits their corporate interests, and without much regard to the interests of any given country (McMichael 1996; Sklair 2001).

This twenty year period has also witnessed an astounding growth of the corporations that control this global economic activity. Corporate revenues of the world's 500 largest corporations, the "Global 500", are now nearly 30 percent of world GDP. Another statistic is particularly telling: of the world's 100 largest economies today, 51 are corporations and 49 are countries.

And these corporations are increasingly transnational in scope (Anderson and Cavanaugh 2001). The number of international subsidiaries of the Global 500 has grown from approximately 1,200 in 1960 to nearly 20,000 in 1998 (Kentor 2003). Moreover, there has been a dispersion of the geographic locations of the Global 500. In 1960, the vast majority of global 500 firms were located in a single country, the United States. By 1998, the U.S. accounted for only 37 percent of these companies, which are now headquartered in 25 countries.

Research Question

We propose to study the hypothesized separation of economic and geographic space by examining the extent to which interlocking corporate directorates have become less tied to geographic boundaries of the nations within which they are headquartered and are now increasingly transnational in scope. This "transnationalization" of interlocking directorates is a reflection of similar economic interests among transnational corporations, and a select group of individuals, which is no longer synonymous with the interests of any given country (Carroll and Fennema 2002, Kentor and Jang 2003, Robinson and Harris 2000).

Our *research hypothesis* that follows from the above discussion is, therefore: the separation of economic and geographic space will generate increased international interlocking directorates between transnational corporations, and a relative weakening of their domestic linkages, between 1970 and 2000.

Data

Data will be collected on geographic location of the world's 500 largest corporations as identified by Forbes Magazine, and the compositions of their boards of directors, at 10 year intervals between 1970 and 2000. This information is readily available from a variety of sources,

including Dun and Bradstreet, Standard and Poor's and Moody's Directories. The data for 1980 and 2000 have already been collected (Kentor 2003). The director data will be entered into a software program written for this purpose, enabling us to calculate the domestic and international linkages (interlocks) between these firms.

Methodology

These data will be analyzed with a relative new spatial analysis technique known as *geographically weighted regression* (GWR). GWR quantifies the extent to which relationships between independent and dependent variables vary over a given geographic space. Specifically, it will enable us to estimate the extent to which corporate interlocks are affected by geographic location. We expect this spatial impact on interlocking directorates to decrease over the 30 year period in question, although this de-coupling is likely to display regional differences and patterns. GWR will also help to identify the factors that correlate with these differences.

Spatial dependence, spatial heterogeneity and statistical analysis

GWR quantifies two critical dimensions of the relationships between geo-referenced independent and dependent variables, namely, *spatial dependence* and *spatial heterogeneity*. Spatial dependency refers to the tendency for observations that are closer in geo-space to be more closely related that observations that are spatially distant. Standard regression analysis suffers if spatial dependency is present in the data: regression parameter estimates are not efficient and significance tests are unreliable in the presence of spatial autocorrelation (Anselin and Griffith 1988; Miron 1984). Spatial heterogeneity occurs since every location has an intrinsic degree of uniqueness due to its situation with respect to the rest of the spatial system. This results in the estimated parameters of a spatial model being inadequate descriptors of the process at any given

location due to parameter drift across space (Anselin, Dodson and Hudak 1993; Fotheringham, Charlton and Brunsdon 1996, 1997; Fotheringham and Rogerson 1993).

Capturing spatial dependency in regression not only corrects the statistical problems mentioned above but can also extract additional information. Spatial dependency can indicate the presence of an unmeasured geographic effect (Bivand 1984). Determining the missing geographic effect can result in a more parsimonious model structure since it can be captured more directly rather than through indirect surrogates (i.e., the variables currently in the model). Techniques for capturing spatial dependency in regression have been available for approximately two decades; these include spatial autoregression and mixed regression-spatial autoregression models (Anselin 1988, 1993; Bivand 1984). Although useful, a problem is that these techniques still assume spatial homogeneity, i.e., they generate global parameter estimates that are assumed to describe the process adequately everywhere. Recent breakthroughs in spatial statistics are disaggregate or "local" measures of local spatial dependency. These are sometimes referred to collectively as local indicators of spatial association or LISA statistics; examples include the G statistic(Getis 1989, 1991; Getis and Ord 1992, 1996; Ord and Getis 1995), as well as local versions of traditional global spatial autocorrelation measures such as Moran's I, the Geary statistic and the gamma statistic (Anselin 1995).

The GWR technique

GWR capitalizes on long-standing developments in spatial regression with more recent advances in local measures of spatial association. GWR captures both spatial dependency and spatial heterogeneity in regression analysis. The basic GWR model is as follows (Fotheringham and Brunsdon 1999). Consider a standard regression model:

$$y_i = a_0 + \sum_{k=1}^{m} a_k x_{ki} + \varepsilon_i \, , \, i = 1,...,n$$

where y_i is the dependent variable for location *i*, $x_{ki}, k = 1...m$ are a set of independent variables, a_k are the regression parameters corresponding to the *m* independent variables, a_0 is the intercept term, ε_i is an error term and *n* is the number of locations. In this standard model, one parameter is estimated for the relationship between each independent variable and the dependent variable. GWR is an extension of standard regression that allows the parameters to vary by location, allowing the model to be rewritten as:

$$y_i = a_{0i} + \sum_{k=1}^{m} a_{ki} x_{ki} + \varepsilon_i \ , i = 1,..., n$$

where a_{ki} is the relationship between the kth independent variable and the dependent variable specific to location i and a_{0i} is a location-specific intercept.

GWR estimates the location-specific parameters using weighted least squares in a manner similar to kernel regression and kernel density estimation, except that weights are based on locations in geographic rather than attribute space. The GWR estimator function is:

$$\hat{\mathbf{a}} = \left(\mathbf{X}^T \mathbf{W}_i \mathbf{X}\right)^{-1} \mathbf{X}^T \mathbf{W}_i \mathbf{y}$$

where $\mathbf{W}_i$ is an n by n diagonal matrix whose elements indicate the influence of each location in the dataset on the given location i. GWR also supports comparisons of locally-varying parameter estimates with global estimates to assess whether GWR explains more of the data variance than the traditional, global approach. A statistical test is also available for assessing whether the parameter drift is significant across space. These tests can be used in both confirmatory and exploratory modes. With respect to the latter, the analyst can find other independent variables that display similar spatial patterns to the parameter drift and enter these into the GWR equation in a stepwise manner and retain these variables if they significantly

reduce the drift. As mentioned above, this can lead to more parsimonious and powerful models (Brunsdon, Fotheringham and Charlton 1996; Fotheringham, Charlton and Brunsdon 1997).

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In *Forces of Labor*, I put forward a set of theses about the time-space dynamics of world labor unrest from the late-nineteenth century to the present. They can be summed up as follows:

1) The main location of working-class formation and protest has shifted *within* global industries along with shifts in the geographical location of production (*spatial fixes*). Major waves of labor unrest are both a significant cause and a significant effect of this process.

2) The main sites of working-class formation and protest has shifted *from industry to industry* together with the rise/decline of leading sectors of capitalist development (*product fixes).*

3) Intra-industry spatial shifts (thesis #1) tend to be from core (high wage) to more peripheral (low wage) locations (consonant with the expectations of product cycle theory).

4) Technological fixes (the reorganization of the labor process and the introduction of new technologies) have tended to re-establish the competitive advantage of core locales, leading to a reconsolidation of production in the core, and a concomitant reversal of the core-periphery shift in working-class formation/protest.

5) With each spatial *fix* (within a product life cycle), new working-class formation and protest takes place in an increasingly competitive environment, making it more difficult to secure the resources needed to establish stable labor-capital accords and bring labor militancy under control. This thesis is consonant with the thesis that sees the semiperiphery (and increasingly the periphery) as a "zone of turbulence".

6) Variations from the above dynamics are to be expected as a result of contingent (although not random) outcomes of political struggles that shape relations among labor, capital and states (see for example the discussion of the "Japanese anomaly" in *Forces of Labor*, chapter 2).

The foregoing theses focus on world-economic dynamics; however, the time-space patterning of world labor unrest is also shaped by (and shapes) world-political dynamics. As such:

7) World wars have had a strong effect on the overall pattern of labor unrest: world labor unrest rose on the eve of the world wars, declined during the initial years of the wars, and exploded in their aftermath. This pattern is characteristic not only of the belligerent countries, but also of countries not directly involved in the fighting. The above relationship is less strong in the case of wars that are not world wars.

8) Periods of world hegemonic crisis/breakdown have been periods of relatively high levels of "dysfunctional" social conflict (including dysfunctional labor-capital conflict). Periods of world hegemony have been periods of relatively stable social compacts and low levels of "dysfunctional" social conflict. The "dysfunctional" social conflict that exists tends to be localized outside the core in periods of world hegemony (consonant with thesis #5); it tends to become more spatially widespread in periods of world hegemonic crisis/breakdown.

9) World labor unrest in periods of hegemonic crisis/breakdown has shaped the institutional structures of subsequent hegemonic world orders in significant ways, transforming the social-political terrain on which world labor unrest unfolds.

Industrialized warfare in the twentieth century increased labor's bargaining power. Post-industrial warfare in the early twenty-first century has weakened labor's bargaining power.

One underlying assumption of the foregoing theses is that the outcome of waves of labor unrest depends in important ways on the nature and extent of workers' bargaining power. *Spatiality*, in turn, is an important component of the conceptualization and measurement of the main forms of workers' bargaining power. Thus: *Workplace bargaining power* is defined as the power that results from the ability of strategically *located* workers to disrupt production in an entire workplace, firm, industry, national, regional, and/or global economy (or an entire network of distribution, as can be the case with transport workers). *Associational bargaining power* is defined as the power that comes from the collective organization of workers, which in turn, is shaped by the *location* of workers within such non-workplace networks as those of kinship, neighborhood and community.

The Time-Space Mapping of World Labor Unrest[1]

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I. Theses

In *Forces of Labor*[2], I put forward a set of theses about the time-space dynamics of world labor unrest from the late-nineteenth century to the present. They can be summed up as follows:

1) The main location of working-class formation and protest has shifted *within* global industries along with shifts in the geographical location of production (*spatial fixes*). Major waves of labor unrest are both a significant cause and a significant effect of this process.

2) The main sites of working-class formation and protest has shifted *from industry to industry* together with the rise/decline of leading sectors of capitalist development (*product fixes).*

3) Intra-industry spatial shifts (thesis #1) tend to be from core (high wage) to more peripheral (low wage) locations (consonant with the expectations of product cycle theory).

4) *Technological fixes* (the reorganization of the labor process and the introduction of new technologies) have tended to re-establish the competitive advantage of core locales, leading to a reconsolidation of production in the core, and a concomitant reversal of the core-periphery shift in working-class formation/protest.

5) With each spatial *fix* (within a product life cycle), new working-class formation and protest takes place in an increasingly competitive environment, making it more difficult to secure the resources needed to establish stable labor-capital accords and bring labor militancy under control. This thesis is consonant with the thesis that sees the semiperiphery (and increasingly the periphery) as a "zone of turbulence".

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[1] Paper to be presented at the "Specialist Meeting on Globalization in the World-System: Mapping Change Over Time", University of California, Riverside, February 7-8, 2004.
[2] Beverly J. Silver, *Forces of Labor: Workers' Movements and Globalization Since 1870,* Cambridge University Press, 2003.

6) Variations from the above dynamics are to be expected as a result of contingent (although not random) outcomes of political struggles that shape relations among labor, capital and states (see for example the discussion of the "Japanese anomaly" in *Forces of Labor*, chapter 2).

The foregoing theses focus on world-economic dynamics; however, the time-space patterning of world labor unrest is also shaped by (and shapes) world-political dynamics. As such:

7) World wars have had a strong effect on the overall pattern of labor unrest: world labor unrest rose on the eve of the world wars, declined during the initial years of the wars, and exploded in their aftermath. This pattern is characteristic not only of the belligerent countries, but also of countries not directly involved in the fighting. The above relationship is less strong in the case of wars that are not world wars.

8) Periods of world hegemonic crisis/breakdown have been periods of relatively high levels of "dysfunctional" social conflict (including dysfunctional labor-capital conflict). Periods of world hegemony have been periods of relatively stable social compacts and low levels of "dysfunctional" social conflict. The "dysfunctional" social conflict that exists tends to be localized outside the core in periods of world hegemony (consonant with thesis #5); it tends to become more spatially widespread in periods of world hegemonic crisis/breakdown.

9) World labor unrest in periods of hegemonic crisis/breakdown has shaped the institutional structures of subsequent hegemonic world orders in significant ways, transforming the social-political terrain on which world labor unrest unfolds.

10) Industrialized warfare in the twentieth century increased labor's bargaining power. Post-industrial warfare in the early twenty-first century has weakened labor's bargaining power.

One underlying assumption of the foregoing theses is that the outcome of waves of labor unrest depends in important ways on the nature and extent of workers' bargaining power. *Spatiality*, in turn, is an important component of the conceptualization and measurement of the main forms of workers' bargaining power. Thus: *Workplace bargaining power* is defined as the power that results from the ability of strategically *located* workers to disrupt production in an entire workplace, firm, industry, national, regional, and/or global economy (or an entire network of distribution, as can be the case with transport workers). *Associational bargaining power* is defined as the power that comes from the collective organization of workers, which in turn, is shaped by the *location* of workers within such non-workplace networks as those of kinship, neighborhood and community.

II. Methods of Analysis

Relational Processes

A central premise underlying the above theses is that workers and workers' movements located in different states/regions (and different time periods) are linked to each other by the world-scale division of labor and by global political processes. Thus, an understanding of *relational processes among "cases" on a world scale across both time and space* is fundamental to understanding the dynamics of labor movements.

It is helpful to distinguish between two different types of relational processes: (1) "direct" and (2) "indirect". In the case of *direct relational processes*, the actors are aware of and consciously promoting the links among the cases. These direct relational processes can be further subdivided into two different forms: diffusion and solidarity. In the case of diffusion, actors located in "cases" that are separated in time and space are influenced by the spread of information about the behavior of others and its consequences. "Social contagion" is a common image used in the methodological literature on diffusion. Historically, labor migration has been an important process promoting the diffusion of political ideologies and forms of labor protest. Diffusion can take place without active cooperation between the source site and recipient site of the "social disease" (e.g., as with the spread of information through the print or electronic media). In contrast, the second form of direct relational processes—solidarity—involves personal contact and the development of social networks and organizations—transnational social networks and organizations in the case of labor internationalism.

The specific contribution of the world-systems perspective to social analysis is its focus on what I have called *indirect relational processes*. Indeed, the theses outlined above mostly refer to indirect relational processes. In the case of indirect relational processes, the affected actors are often not fully conscious of the relational links. Rather, actors are linked behind their back by systemic processes including the unintended consequences of a series of actions and reactions to the contradictions characteristic of historical capitalism. Thus, for example, if capitalists respond to a strong labor movement by relocating production to a new site (thus weakening labor in the de-industrializing site but strengthening labor in the industrializing site), then we can say that the fates of these two labor movements are linked by indirect relational processes.

Taking the example of late-nineteenth-century migration, we can detect both indirect and direct relational processes linking labor movements across time and space. The spread of labor movement ideologies and practices as workers moved across the globe is an example of diffusion. But, we can also detect critical indirect relational processes. The U.S. labor movement's success in having open immigration outlawed in the 1920s set the stage for the stabilization of the U.S. working class and contributed to the subsequent CIO (Congress of Industrial Organizations) victories in the 1930s. At the same time, however, this U.S. labor movement "success" shut off what had been an essential safety valve for Europe in the nineteenth century (mass emigration). It thereby transformed the

terrain on which workers' movements operated in Europe, and according to E.H. Carr[3], helped set the stage for the defeat of European labor movements and the rise of fascism.

Limits of the Comparative-Historical Approach

If we are to make relations among the cases across time and space a central part of the explanatory framework, then we cannot rely on the comparative-historical strategy of research. The comparative-historical perspective, like the approach taken here, criticizes the strategy of making generalizations from one or a limited number of cases, and thus calls for widening the geographical scope of analyses. Much of the comparative-historical literature follows the strategy of "splitting" in search of distinctiveness in contrast to a strategy of "lumping" cases in search of commonalities and generalizations (Hexter 1979, 241-2; Collier and Collier 1991, 13-15). The problem arises, however, in the next research step in comparative-historical analyses—that is, tracing the differences in outcome to preexisting and *independently produced* differences in the *internal* characteristics of the various cases.

While comparative-historical sociologists have produced some of the most interesting recent scholarship in labor studies, the research strategy nonetheless impedes full access to what we take to be a key explanatory variable of labor movement behavior and outcome (i.e., the relationships among the cases themselves). As Charles Tilly among others has pointed out, the results of a strict cross-national analysis may be misleading. A social unit's connection to the whole system of social relationships in which it is embedded "frequently produces effects [that] seem to be autonomous properties of the social unit itself."[4] As a result, the patterned diversity among the social units *appears* to be consistent with cross-national variation-finding explanations. This has been referred to as "Galton's problem" in the anthropology literature: that is, in a situation in which cases are *presumed* to be independent—but are actually linked relationally—the relations among the cases become a lurking (unexamined) variable. Indeed, in the theses outlined above, similarity/variation among labor movements is not merely the outcome of the cases' similar/different independent and pre-existing characteristics. Rather, the relationships among the cases, and relationships between the cases and the totality, are key parts of the explanation of similar/different outcomes.[5]

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[3] E.H. Carr, *Nationalism and After*, Macmillan, London, 1945.

[4] Charles Tilly, *Big Structures, Large Processes, Huge Comparisons*, Russell Sage Foundation, 1984, page 146.

[5] For a methodological critique of the comparative-historical approach from a world-systems perspective, see Terence K. Hopkins, "The Study of the Capitalist World-Economy", in T.K. Hopkins, I. Wallerstein and Associates, *World-Systems Analysis: Theory and Methodology*, 1982, pages 9-38. On Galton's problem, see Raoul Naroll, "Galton's Problem", in Raoul Naroll and Ronald Cohen, editors, *A Handbook of Method in Cultural Anthropology*, The Natural History Press, 1970, pages 974-89; and E. A. Hammel, "The Comparative Method in Anthropological Perspective", in *Comparative Studies in Society and History*, 22, 2, April, pages 145-55.

In sum, we require an analytical strategy that is sensitive to the relational processes among key actors (labor, capital, states) in the world capitalist system as a whole, as well as the systemic constraints affecting those actors. Needless to say, such an approach presents enormous problems of complexity, and a strategy for reducing complexity and making research feasible is needed.

Encompassing Versus Incorporating Comparisons

The most well known strategy for reducing the complexity of world-historical analysis is what Tilly labeled "encompassing comparison" and is best illustrated by Immanuel Wallerstein's approach to the study of the "modern world system" and John Meyer's approach to the study of "world society". Encompassing comparisons reduce complexity by starting "with a mental map of the whole system and a theory of its operation." Similarities/differences in the attributes and behavior of the units are then traced to their similar/different position within the overarching totality.[6] Meyer's "mental map" of the system leads him to emphasize a growing convergence among national cases as a result of a world-scale process of "rationalization". Wallerstein's mental map, in contrast, leads him to emphasize a process of recurrent geographical differentiation among core, semiperiphery and periphery, resulting from the unequal distribution of rewards in a capitalist world economy. Yet for both, local attributes and behavior are seen as the product of a unit's location in the system. The larger system has a steamroller-like quality, transforming social relations at the local level along a theoretically expected path. This approach has led to complaints from otherwise sympathetic scholars that "world systems theory" in "assuming the systematicity and functionality of the capitalist world system", has produced a "mechanical picture of different labor forms in different parts of the world."[7]

The strength of Wallerstein's perspective is that it emphasizes the very real constraints that the totality imposes on the range of possible action open to local actors. But its weakness is that it excludes a priori a situation in which local action (agency) significantly impacts local outcomes, much less a situation in which local agency impacts the operation of the system as a whole (as are foreseen, for example, in Theses #6 and #9 above). Thus, while keeping in focus the real systemic constraints that the totality imposes on local actors, the "encompassing comparison" approach was not adopted in *Forces of Labor* as a strategy for reducing complexity. Instead, the research strategy adopted is closest to what Philip McMichael has called "incorporating comparisons"—a strategy in which the interactions among the multiplicity of subunits of the system are seen as *creating* the system itself over time. The resultant conceptualization is one in which *relational processes in space unfold in and through time.*[8]

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[6] Tilly, op cit, page 124.
[7] Frederick Cooper, "Farewell to the Category-Producing Class?" In *International Labor and Working-Class History,* 57, Spring, 2000, pages 60-68 (quote from page 62).
[8] Philip McMichael, Íncorporating Comparison within A World-Historical Perspective: An Alternative Comparative Method". *American Sociological Review,* 55, 1990, pages 385-97.

Constructing Narratives as a Mode of Causal Analysis

The approach outlined above necessarily leads to a narrative mode of causal analysis—in some ways similar to that advocated by historical sociologists. The narrative strategy, Larry Griffin has argued, allows us to understand social phenomena "as temporally ordered, sequential, unfolding and open-ended 'stories' fraught with conjunctures and contingency".[9] As a strategy for *explanation*, "descriptively accurate narratives, which depict a sequence in chronological order… do more than tell a story," according to Jill Quadagno and Stan Knapp. Such narratives can "serve among other purposes, to identify causal mechanisms" because "when things happen…affects how they happen."[10] But while historical sociologists have stressed the importance of treating *time* as dynamic, they have generally continued to treat *space* as static (e.g., conceptualizing national cases as fixed, independent units). In contrast, *Forces of Labor* sought to create a narrative of working-class formation in which events unfold in *dynamic time-space.*

Terrence Hopkins' contention about the purposes and limits of statistical elaboration in the *historical social sciences* is relevant here. Hopkins argued that the purpose of statistical elaborations should not be "explanation" but rather should be the identification of patterns across time and space that then become the explicandum of a multidimensional causal "story". Capturing the causal processes themselves, Hopkins argued, requires a narrative rather than a statistical mode of analysis.[11]

Question for the Conference Specialists: An obvious question to pose now, in the context of this conference, is whether GIS in combination with network analysis and/or hierarchical linear modeling can offer more sophisticated tools for the clear identification of patterns across time and space as the first step in setting out the "what is to be explained," with the second step being the construction of a compelling causal narrative? Is this a widely accepted way of using GIS (with or without HLM and/or network analysis), in contrast, say, to the almost universal understanding that regression analysis is a tool for causal modeling rather than pattern identification? (Indeed, when I have used regression analysis as a pattern identification tool, readers have almost invariably misunderstood what I was doing; they assumed I was attempting to build a causal "model", and critiqued it on those grounds—despite explicit statements made about the methodological approach being used.)

[9] Larry Griffin, "Temporality, Events, and Explanation in Historical Sociology: An Introduction", in *Sociological Methods and Research,* 20, 4, May, 1992, pages 403-427 (quote from page 405).
[10] Jill Quadagno and Stan Knapp, "Have Historical Sociologists Forsaken Theory: Thoughts on the History/Theory Relationship", in *Sociological Methods and Research,* 20, 4, May, 1992, pages 481-507 (quotes on pages 486, 502.)
[11] Terence K. Hopkins, "World-Systems Analysis: Methodological Issues," in T.K. Hopkins, I. Wallerstein and Associates, *World-Systems Analysis: Theory and Methodology,* 1982, pages 145-58 (quote from page 32); see also Arthur C. Danto, *Analytical Philosophy of History,* Cambridge University Press, 1965, page 237.

Mapping Patterns with the World Labor Group Database

In order to pursue the research strategy described above, we need empirical maps of the time-space patterning of the phenomena of interest—in the case of *Forces of Labor*, an empirical map of the time-space patterning of labor unrest. The map is needed to allow us to navigate a path through the bewildering totality of potentially relevant episodes of the phenomenon of interest in the time-space span of interest. In other words, it allows us to identify patterns across time/space and thus make informed decisions about what/where/when to study more closely. The empirical map allows us to "lump" and "split" cases as a tactic for uncovering the patterns to be explained through the construction of relational narratives.

The first problem is that for most phenomena of interest, information of sufficient geographical and historical scope to construct the type of empirical map needed is not readily available. *Forces of Labor* relied on the World Labor Group (WLG) Database, which was constructed specifically for the purpose of this and related research. Building on a well-established tradition within the social sciences, the database was constructed by using information from newspaper reports of labor unrest (strikes, demonstrations, factory occupations, food riots, etc.) throughout the world beginning in 1870. The result is a database with over 91,947 "mentions" of labor unrest for 168 "countries" covering the 1870-1996 period, with information on the article date, action-type, industry (if specified) and sub-national location (if specified) for each mention.

The database was compiled by reading through the Indexes of *The Times* (London) and the *New York Times* from 1870 to 1996 and recording each incident of labor unrest identified onto a standard data collection sheet. This was a process that required an *enormous* input of labor, first in the design and testing of the coding procedures, and then in the very labor-intensive process of reading through the Indexes and recording the information, and finally entering and numerically coding the data in computer files in database and time series form, and subjecting the resulting time series for individual countries to reliability studies. I often joke that if we had known what we were getting into (that is, accurately estimated the total amount of work involved), we never would have done it.

Would building another such world-historical database (on say, student unrest or peasant unrest) require another decade-long commitment? The WLG project began in the mid-1980s, before newspaper content was digitized and available online. Does the availability of digitized sources open up possibilities for the construction of a wide array of similar databases with a fraction of the time input? The question is worth exploring, but two cautions are already in order. The first caution is based on my experience with digitized searches. Hoping to update the WLG from 1997-2003 without having to hand search the paper indexes, I carried out a test on the digitized full text version of the *New York Times* using search strings designed to "catch" the same labor unrest articles that would have been caught by a human coder reading the paper Index. Significant problems in the comparability of results from the two methods arose. A computerized search of the full text both missed articles found by human readers and found articles missed by human

readers. The latter were relying on the less extensive content of the Index compared to the digitized articles' full text. (Digitized versions of the Index—as opposed to the full text of the articles—are not available.)

Of course, this would not be a problem for a database created from scratch, as long as each method produced internally consistent results over time. Nevertheless, the surprising finding was that the time involved was not substantially less for the computerized search. This is because the computerized search produced a large number of false positives that had to be eliminated by hand. (The computer had a hard time distinguishing, for example, between oil workers striking and workers striking oil). Nevertheless, with care, a sufficiently valid and reliable approach to data collection using digitized newspaper sources might be developed (albeit, most likely not one that is helpful for updating the WLG database in a comparable fashion). Bruce Podobnik (at Lewis and Clark), for one, has been constructing a database on anti-globalization movements relying on digitized newspaper reports from around the world.

The second caution is the usual data-theory caution—for one can go from dying of thirst for data to drowning in a sea of data. The massive amount of data that can be produced (in the case of the WLG, 91,947 mentions of labor unrest) can only be turned into interesting/observable patterns and compelling explanations by bringing the lenses of theory to bear on what would otherwise be an overwhelming jumble of empirical observations.

David Smith, University of California, Irvine

"World cities" (Hall, 1966; Friedmann and Wolf, 1982) and "global cities" (Sassen, 1991) have increasingly attracted the attention of urban-focused social science research since Peter Hall introduced the idea in the mid-1960s. Social scientists working on comparative social change are now concerned with situating these cities conceptually and empirically within the broad currents of the world political economy (e.g., Smith, 1996; Timberlake, 1985). A more recent development among scholars of cities, urbanization, and development is to view city networks as constituting an important structural dimension of the world system. From this perspective, the great cities of the world are organizational nodes in multiple global networks of economic, social, demographic, and information flows. This relational view allows us to begin to think about mapping cities in terms of their structural relationships with one another. This, in turn, suggests a research agenda the objectives of which range from describing the structure of a world network of cities, to identifying and explaining hierarchical relations among world cities, to understanding the "nesting" of the world city network into the broader world-system, to analyzing the connections between particular cities' places in the global hierarchy and social relations within them.

The World-System's City System: A Research Agenda

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Introduction

"World cities" (Hall, 1966; Friedmann and Wolf, 1982) and "global cities" (Sassen, 1991) have increasingly attracted the attention of urban-focused social science research since Peter Hall introduced the idea in the mid-1960s. Social scientists working on comparative social change are now concerned with situating these cities conceptually and empirically within the broad currents of the world political economy (e.g., Smith, 1996; Timberlake, 1985). A more recent development among scholars of cities, urbanization, and development is to view city networks as constituting an important structural dimension of the world system. From this perspective, the great cities of the world are organizational nodes in multiple global networks of economic, social, demographic, and information flows. This relational view allows us to begin to think about mapping cities in terms of their structural relationships with one another. This, in turn, suggests a research agenda the objectives of which range from describing the structure of a world network of cities, to identifying and explaining hierarchical relations among world cities, to understanding the "nesting" of the world city network into the broader world-system, to analyzing the connections between particular cities' places in the global hierarchy and social relations within them.

Leading scholars focusing on world cities contend that economic power inheres in a few key "global cities", where the world economy's key functions, such as financial and other producer services (Sassen, 1991), are concentrated. The top cities are followed in the hypothesized hierarchy of world cities by less influential sub-global cities which, nevertheless, are said to "articulate" among large regions of the world economy. The picture emerging from this body of scholarship is that of a hierarchical world-system of cities (see Knox and Taylor, 1995), and though this hierarchy is subject to change, the consensus is that the particular cities at the top of the global hierarchy have changed little in recent history. But this rich and evocative line of scholarship tends to fall short empirically: it rarely is based on actual analysis of data on the *relationships* undergirding the global network of cities. We need to develop much better indicators of actual links and flows between these great cities in order to evaluate some of this perspective's most important assumptions, and to develop more accurate descriptions of world city system structure and changes therein. Such a project will provide an alternative strategy for evaluating theories of globalization, one based not on a system of nation states alone, but one defined by examining the contours of a world-wide system of cities. Paralleling the scholarship comparing world cities is another body of urban research focusing on coalitions of actors within particular cities who are compelled by their land-based interests to push "their" cities into competition for more prominent roles in this global hierarchy (Logan and Molotch 1987; Rondinelli, Johnson and Kasarda 1998; Scott 2001). This suggests a promising way to link the "global" and the "local". In fact, local political actors are increasingly consciously using the language of globalization to justify putting public resources into making their cities more competitive globally (e.g., Saito and Thornley, 2003). With information on the theoretically relevant attributes of each city in the hypothesized network, we will be able to develop and test propositions about how variations in local economic and social relations are related to global network relations. At the same time, there are strong theoretical reasons to look for "upward links" between this hypothesized global city system and other global networks within which this system is assumed to have been produced: the set of global relations in which nation states are the chief constituent parts, thereby evaluating some of the claims about "denationalization" and the "deterritorialization" of the state that are made in the globalization literature.

1. Objectives and Significance

The objectives of the proposed research are to test the implications of theoretical developments about globalization and "world cities" by refining and analyzing three relevant data sets: (1) data on world city network relations from 1980 to the present, (2) an international trade model of the world-system for the same time period, and (3) a database on the theoretically significant attributes of those world cities that are included in the network database. We plan to conduct descriptive and explanatory analyses of these data, and to make these data available for use by other scholars of world cities and comparative

social change. The focus of the proposed research is on relations among the world's large cities and it will involve collecting information on interlinkages between pairs of cities in a hypothesized world network of great cities. The research will also develop measures of theoretically important attributes of each city in the network. We will perform the initial analyses of these data with the aim of providing both a description of the world city network for specific points in time and a description of how it changes over time (based on formal network analysis of these data). We will investigate the way the global city network is nested and articulated into the relational world-system of nations, and offer explanatory analyses of the relationships among the changing structure of the network, other global socioeconomic processes, and theoretically significant attributes of the cities (based on combining the results of the formal network analysis with more conventional variable-based analytic procedures, such as OLS regression).

The proposed research reflects our longstanding goal to understand the global dimensions of urbanization and urban change. This project focuses on understanding large scale social change in light of global processes and structures. It also involves examining the articulation between global structural change and social structures and processes manifest at the local level. In many ways the research can be seen as an extension of a project that began in one co-PI's dissertation exploring the cross-national relationship among urbanization, international dependence, urban labor force structure, and social quality (Timberlake, 1979; Evans and Timberlake, 1980). Collaboratively, we further developed this line of work in the early 1980s under the auspices of Christopher Chase-Dunn's NSF-supported research aimed at framing urbanization processes within an international political economy perspective. This project resulted in a number of theoretical and empirical scientific publications exploring the relationships, on one hand, among urbanization patterns, global urban hierarchy, and the growth of particular cities and, on the other hand, among urbanization patterns, national-level socioeconomic and political trends, and international dependency and world-system relations (e.g., Timberlake and Kentor, 1983; Chase-Dunn, 1985; Kentor, 1982, 1985; Timberlake, 1985; Nemeth and Smith, 1985a). Much of this research viewed urbanization and urban hierarchy partially as outcomes of national level processes, such as industrialization, and global processes, such as foreign investment dependence. Later, the long-term project took a new turn. Instead of viewing cities and urbanization as derivative, we began to view cities as crucial basing-points in a global network. From this perspective, inter-city relations are, in part, constitutive of "globalization." We developed this line of inquiry in several theoretical and empirical publications (Smith and Timberlake, 1995a, 1995b, 1998, 2001; Shin and Timberlake, 2000). The findings of these efforts are discussed in more detail below.

The roots of our efforts are found in important themes in comparative sociology, urban ecology, and urban geography. It resonates with the work of other scholars who are currently attempting to shed light on the ways in which cities are involved in the macro-level processes associated with what now is commonly termed as "globalization."

World City Networks & Hierarchies. McKenzie and other early urban scholars saw cities in terms of a system of cities, related to one another along a dimension of power. Some of his work is prescient of much more recent research: global integration, world-wide hierarchies of dominance, and competition and change were all important themes in it: "Old centers lose their relative importance as new factors enter to disturb the equilibrium....New centers of dominance are arising..." (McKenzie, 1927). More than a generation later, the same logic appears in the work of scholars of urban planning such as Peter Hall (e.g., 1966) and John Friedmann who are the immediate pioneers of the now extensive body of research on world cities. In 1986 Friedmann produced a ranked list of key world cities, providing a figure that "maps" the linkages between them. He argues that world cities can be located in a global hierarchy based on their positions in the global geographic nexus of economic power: "Cities can be arranged hierarchically, roughly in accord with the economic power they command (1995: 25-6). Moreover, because cities can rise and fall in this hierarchy it becomes important to recognize "the existence of differences in rank and investigate the articulations of particular world cities with each other" (23). Friedmann labels world cities as either "primary" or "secondary," according to

location within the world-system core or semiperiphery. Thus, he provides a rough map of the world city system based on the functional importance of these city-nodes. New York, London, Tokyo and Los Angeles are among the highest ranking "core primary cities" in his scheme – an intuitively appealing result. Saskia Sassen probably provides the most thorough treatment of "the world city hypothesis" in *The Global City: New York, Tokyo, and London* (1991). Here she provides a global overview of her version of the notion, detailed case studies of the three great metropolitan centers, and a synthetic conceptual argument, including an overview of contemporary globalization processes and the dynamic roles that world cities play in them. She claims various functions relating to the "command and control" of today's world-economy concentrate in global cities, even as manufacturing is increasingly dispersed to ever more far-flung regions of the world. These cities are the "command posts for the world economy," the sites for global finance and other specialized service firms, the sites of key innovations, including innovations in services, and they are "markets for the products and innovations produced" (Sassen 1991:3-4).

A number of other case studies have largely substantiated John Friedmann's notion that there is a distinct category of "global" and "world cities" housing activities and organizations that exert international coordination and control (for example, King 1990; Ross and Trachte 1990; Sassen 1991, 2002), and there are fine examples of more historical comparative case studies of cities in the context of global political economy (for example, Rodriguez and Feagin, 1986; Smith and Feagin, 1987; Hill and Feagin, 1987; Feagin, 1988). Castells (1989, 1994) pulled various strands of the global restructuring/world cities literatures together. He emphasizes the key role of "information technology" as an underpinning for contemporary globalization, arguing that "the national-international business center is the economic engine of the city in the informational global economy" (1994:29). Castells' work predicts that dominant global cities will rise to commanding heights by developing the infrastructure that is required to "capture" key information flows, leading to spatially defined urban hierarchies. Therefore, understanding urbanization requires a *network-based relational view* of how structural similarities among cities and social change within cities are influenced by world-systemic processes.

Conceptualizing Linkages Among the World's Cities. Though the most obvious kinds of flows among cities are those of an explicit economic nature, such as commodity flows, there are other important ways in which cities are connected. Other economic linkages among cities in the human form include flows of labor, sales and producer-services personnel, and managers. When people migrate or immigrate from one city to another in order to find employment they represent labor flows. An immigrant from Tijuana to Los Angeles, drawn into the garment industry there, is an example. When a manager travels from corporate headquarters to the site of a branch plant in another city, this represents an economic flow in the human form. The primary material objects linking cities can be traced in the flow of commodities, both in the production process and in the distribution process. Some cities house important value-added processes for commodities that are shipped into the city from other urban locales. Cotton fabric is shipped daily to factories in New York, Los Angeles and other cities with garment industries. Other cities house break-of-bulk transportation facilities for moving commodities to smaller cities where they will be purchased by consumers. Examples of economic flows taking the form of symbolic communication include business-related internet-based communication, telecommunications (e.g., telephone calls, faxes, TELEXes, etc.) mail orders, other business-related mail, etc. In principle, detailed information measuring different kinds of flows could be used to produce one or more "maps" of the world system of cities. Figure 1 (adapted from Smith and Timberlake, 1995a) illustrates one possible conceptual organization of the various flows which link cities, weaving them into a global network. (Of course, the same relations also characterize inter-national connections in the world-system, too.)

Figure 1. Typology of Global Inter-City Relations

FUNCTION		**FORM**	
	Human	**Material**	**Symbolic**
Economic	labor migration	commodity flows	faxed orders
Political	ambassadors	arms shipments	threats
Social Reproduction	family migration	remittances	personal mail
Cultural	dance troupes	blue jeans	Hollywood films

Network Analysis. Both world-system analysis and the literature on world cities evoke network imagery and are filled with references to "flows," "exchanges," "nodes," and other words and phrases that evoke network relations. For example, Lo and Yeung describe "the functional world city system" in terms of various linkages, claiming that "world cities are at the points of convergence of these networks and thus acquire growing centrality and importance. Network functions are embodied in financial flows, headquarter-branch relations, high-tech service intensity, and telecommunications networks" (1998:10; and see Meyer, 1986). Although many employ relational imagery, few scholars of global cities attempt to systematically study these types of networks. Most choose instead to focus on case study techniques that describe the ways that particular world cities take on "command and control" functions within global networks.

While the leading theorists may be unlikely to turn to high-powered statistical analysis to test their models of global structure and hierarchy, quantitative network analysis is particularly well-suited for this purpose. With appropriate data, this methodology allows us to simultaneously analyze multiple patterns of flows, exchanges or linkages between cities (or other nodes), revealing the complex patterning of connections between them as well as the structure of the entire network. It gives researchers a powerful tool to examine global flows of people, commodities, capital, information, etc. A number of researchers have used network analysis to examine the structure of the world-system (Snyder and Kick, 1979; Steiber, 1979; Nemeth and Smith, 1985b; Smith and White, 1992; Sacks, Ventresca and Uzzi, 2001), but few have used it to explore the nature of the global system of cities.

Network analysis measures a variety of formal properties of structures and relationships. Two characteristics of networks are of particular interest for studying global city systems. First, the idea of structural or relational equivalence in networks, usually operationalized using various forms of "blockmodeling", is the most familiar technique in previous network research on the global system. Such research seeks to identify the actors (usually nations) that fit together into broad groups or "blocks" according to the way they are similar to each other in terms of their patterns of ties or flows (exchange of diplomats, provision of aid, international trade, migrants, investment, etc.) and different from other sets of actors in these same respects. Snyder and Kick (1979) and Nemeth and Smith (1985b) used the popular CONCOR (Convergence of Iterated Correlations) algorithm (see White, Boorman, and Brieger 1976) that gauged structurally equivalent blocks; later Smith and White (1992) used a relational distance algorithm, called REGE, which more accurately captures the idea of role similarity. These measures of

equivalence provide a technique for grouping nations or cities (or, in principle, other geographic units for which data are available) together according to similarities in their pattern of exchanges. Theoretical notions about the link between a city's functions and its role in the global urban system suggest that cities should group into rough "levels" corresponding to their positions in the world city hierarchy (analogous to the “world-system positions” into which nations group).

In addition to probing overall structures of networks, the methodology also provides insight into the attributes of particular points. One particularly important concept is that of centrality. Sociologists link centrality in communities or interorganizational networks to power, prestige and economic success (Laumann and Pappi, 1976; Laumann, Galaskiewicz, and Marsden, 1978; Galaskiewicz, 1979; Burt, 1982), while anthropologists and geographers have focused on centrality in trade networks between places (for instance Hage and Harary, 1981; Pitts, 1965, 1979). Formal network methodologists argue that there are several distinct types of "centrality," operationalized using different formal measurement algorithms (see Freeman, 1979). Because of technical problems that are only now being solved, quantitative measurement of point centrality is a complex proposition, especially if the data on the flows or relationships between points incorporate information about the amount or value of the exchange (i.e. as opposed to simply reporting presence or absence of a tie) (see White, 1989). But nodal centrality is obviously relevant to understanding world city systems: the key role of world cities as “junctions of flows” (Harris 1994) should be strongly related to a place's ability to control and broker various types of international exchanges, to serve as a source of information and capital flow, and to act as a magnet for certain types of migrants or high technology.

Operationalizing Intercity Linkages for Network Analysis of the Global City System. The various types of intercity flows discussed above are not highly abstract (see Figure 1, above), so they might appear to be straightforward to measure. However obtaining data on actual flows of people, materials and information between global cities presents a particularly daunting task. Further, the nature of network analysis makes missing data particularly problematic.

Because of the way quantitative data are gathered and compiled, there is a dearth of relational data on all social phenomenon. There is growing theoretical interest in the various social sciences on how social structures are generated through the relationships and linkages between people, localities, institutions, nations, etc. (see, for example, Tilly, 1984). But statistical information still tends to be collected in the attributional form. That is, sources report values on the characteristics of particular units (i.e., an individual's income, a city's population, a nation's gross national product) rather than information about their relationship to others (in terms of either links or flows). Therefore, it is very difficult to obtain data on international flows or links between social units (whether these are cities, regions, organizations, corporations, or nations). So while it is easy to get attributional data on various nation-states, and there is some good network data at the inter-national level (commodity trade flows, for instance, see Smith and White, 1992 -- a study we are now replicating and updating), compilations of networks of interactions or flows between world cities are not readily available. This does not mean that these data do not exist or that pulling them together into a useable format is impossible; rather, it means that this task is difficult. The difficulty is compounded by a methodological issue. While network analysis is a powerful tool to understand social structure, it has stringent data requirements. Other types of statistical analysis use relatively simple, standardized ways of adjusting for "missing cases." But incomplete data in network matrices is more difficult to accommodate. An important part of the proposed research will thus involve careful attention to collecting data for as many city pairs as is possible.

Global City Network Data. Economic flows can be embodied in the movement of people when they migrate from one geographic place origin to a distant destination: labor migration. Periodic surveys of national populations for certain periods of time may allow us to piece together a map of global labor flows. Of course, good counts of migrants will not be available for many countries in the world, and when they are, cities of origin may not be coded. But the study

of migration is central to demographic inquiry, so this could be a potentially fertile field for data in the future that might allow us to begin to chart a migration-based world city system grid.

Economic flows in their material form may be operationalized by describing commodity chains linking geographic locales (see Gereffi and Korzeniewicz 1994). The required data would consist of some measure of the nature and volume of commodities by cities of origin and destination. Once again, it's unlikely that complete data for all of the world's large cities are available, but we can begin to piece together a partial map of the world's city system by using the data that are available and making efforts to find new sources. For example, in this country a Commodity Flow Survey is available from the U.S. Department of Transportation. The survey provides a complete network data base (from systematic sampling of commodity flows) on the value and number of commodity flows by zip code. But, since it can only provide data for cities in the U.S., they are not directly useful in a study of global networks. There may, in fact, be data compiled by commercial interests that would be ideal for mapping the morphology of commodity flows between world cities – information on port-to-port movements of containerized trade, for example. However our efforts to obtain these data have been unsuccessful so far. But we ***do*** have complete matrix data, as yet unanalyzed, on air cargo flows between the each nation's leading airport. We plan to examine these data as part of the project.

Communication among actors in geographic locales remote from one another takes place in the absence of face-to-face contact. Firms, businesses, and business people with far-flung operations and interests use e-mail, telephone calls, Telex messages, Faxes, telegraph and postal mail for such purposes. In principle, it should be possible to sample the volume by locale of origin and destination of some of these communications from existing records. But this information also seems to be difficult to obtain. Scholars of the communications industry and the major telecommunications corporations themselves may be willing to cooperate in generating the necessary data to begin to map the global inter-city information network (see, for example, Barnet, 2001). In principle, sampling procedures could generate good estimates of the volume and frequency of telephone transmissions between places on the globe. In his recent analysis Rimmer (1998) provides a survey of the "top 25" international telecommunications routes. But the data are only available for a very limited number of cases and is all compiled at the national level: the connections between "world cities cannot be traced adequately because the data on global traffic are restricted to the largest country-pairs" (Rimmer, 1998:451).

Travelers form other strands in the web linking the world's cities. Corporate emissaries, government trade and commerce representatives, and independent entrepreneurs, for example, move among cities, greasing the wheels of commerce, finance, and production through face-to-face contact. We have data on air travel patterns between pairs of international cities and are beginning to analyze them using network analysis. The proposed research would involve coding, cleaning and supplementing these data with measures of linkages between large cities within the same country, which are not now included in the readily available data sets.

Air Passenger Travel. Like Manuel Castells (1994), Saskia Sassen is convinced that new information technologies that bind together major international financial and business centers are critical to understand the phenomena of world cities (and, indeed, to comprehend the crucial underlying logic of current "globalization") -- "with the potential for global control capability, certain cities are becoming nodal points in a vast communications and market system" (Sassen 1998: 397). At first blush, capturing the essence of that sort of centrality might seem to ***require*** examining the "architecture" of worldwide telematics networks directly, but she goes on to write, "One of the ironies of the new information technologies is that, to maximize their use, we need access to conventional infrastructure. In the case of international networks it takes airports and planes... (1998: 403)."

Fortuitously, information on air travel (and other forms of transportation data like the movement of large transoceanic shipping containers (discussed by Rimmer 1998)), are collected for particular ports or nodes, which usually are in or near major cities. Keeling (1995) presents a

strong argument for both generic claims about “transport's key role in the world city system" (116), as well as specific ones that the air passenger links that we will examine are an excellent source of data:

> Airline linkages offer the best illustration of transport's role in the world city system for five reasons: (i) global airline flows are one of the few indices available of transactional flows of inter-urban connectivity; (ii) air networks and their associated infrastructure are the most visible manifestations of world city interactions; (iii) great demand still exists for face-to-face relationships, despite the global telecommunications revolution (Heldman 1992, Noam 1992); (iv) air transport is the preferred mode of inter-city movement for the transnational capitalist class, migrants, tourists, and high-value, low-bulk goods; and (v) airline links are important components of a city's aspiration's to world city status (Keeling 1995: 118).

Keeling also points out that airports and air connections often become important political issues in various cities. For symbolic reasons as well as for economic self-interest, members of urban growth coalitions seek to gain public support to develop "their" city's airline capacity.

Though no other researchers have used a network analysis of air travel to indicate cities’ position in the global system, many have used related, attributional measures such as number of air passenger arrivals, airport capacity, volume of international flight arrivals for such purposes (e.g., Keeling 1995; O’Connor, 1995; Cattan, 1995). Moreover, O’Connor (2003) even uses some of our earlier, limited passenger travel-based network scores to evaluate shifts “down” the world city hierarchy in airport activity over time. Clearly, air travel linkages are widely regarded among urbanists as an important indicator of a city’s prominence. Of course in using air passenger travel networks to operationalize cities’ positions in the world hierarchy of cities, we recognize that any changes in cities’ relative position also must be interpreted in light of geopolitical events such as war and 9/11, changes in aircraft technology, and changes in the business of airlines, such as shifting the locus of hub and transshipment activity (cf., O’Connor, 2003). By using relatively long-term data beginning in the late 1970s and running through 2000 we should be able to reduce the “signal to noise” problem. Furthermore, we would argue that many of these contextual changes are not independent of processes of globalization, but part of it (e.g., Saito and Thornley, 2003), and they will be interpreted as part of the larger problematic of the proposed research. For example, we will identify important airline hubs and shifts in their locations over time, interpreting the patterns we find in light of this information. Moreover, we recognize airport-construction and hub-siting as potentially significant world-city building strategies that local elites consciously pursue. We should also note that, given the nature of our data, which only includes the leading city from most nations--selectively augmented with a few other places that are clearly “global cites” for very large countries like the United States – means that the sorts of “regional” air hubs that predominate in the U.S. are *not* included. The fact that Hong Kong or Frankfurt emerged as international air hubs during the late twentieth century, we believe, makes a substantive contribution to their “world cityness,” much as Chicago’s emergence as national railroad hub in the Nineteenth Century contributed to its rise in global prominence (Cronon 1991).

Previous Research on City Systems and Air Travel. A few scholars have used air travel in empirical studies comparing cities. In her study of the degree to which European cities are "internationalized," Cattan argues "because of its relatively rapid capacity to reply in terms of supply and demand, air traffic provides a pertinent indicator in the quest to evaluate the

international character of western European cities" (1995: 303). Despite apparently having network-type information, she condenses it to attributional data and shows that variation among European cities' international "attractivity" (in terms of air traffic) is explained by a variety of factors, including each city's relative standing in its national territorial system.

Simon also uses air traffic as one measure of a city's standing in the world-system. "The progressive expansion of civil aviation reflects continued growth in business and international tourism" (1995:139). His analysis reveals "the relative insignificance of sub-Saharan African airports relative to those in the NICs", Cairo as Africa's busiest airport, Johannesburg as sub-Saharan Africa's "gateway," and Lagos as "surprisingly unimportant given (Nigeria's) vast population and considerable potential in view of its economic situation" (139).

More recently, Rimmer (1998) examines both air passenger and freight movement, with particular interest in the former: "Air passenger travel contributes to economic globalization by bringing people together to acquire *complex knowledge* relatively unburdened by geographical constraints and national borders" (his emphasis)(454). He provides a list of the "top 25" metropolitan airports by volume, as well as the "top 25" city-pairs, based on city-to-city volume – and even traces the changing volumes at these airports and routes for each year between 1984 and 1992. With the two-way flows between cities, he is, in effect, doing relational analysis, albeit in a non-rigorous and grossly simplified way. Most of the lead cities he identifies are among those at the top of the world-city hierarchy that we derive from the more sophisticated analysis that follows. But, by ignoring the multiplex linkages between the key nodes and many of the lower-order cities (which he presumably does to make his simple comparisons manageable), Rimmer misses out on a key component of global cities prominence, namely their "command and control" links to less central parts of the global economy.

Our earlier empirical efforts included using formal network analysis of airline passenger travel between 23 world cities (Smith and Timberlake, 1995b) for one point in time (1985) in an effort to evaluate claims about global city hierarchy proffered by Friedmann and Sassen. More recently, using data on1991 airline passengers between all pairs of 110 cities, Smith and Timberlake (1998, 2001) measured the flows between cities to create images of the world urban hierarchy. This corroborated impressionistic accounts about the relative importance of leading world cities (Friedmann, 1995; Sassen, 1991; Smith and Timberlake, 1995a). In equivalence analysis, London, New York, Frankfurt, and Tokyo, joined by Amsterdam and Zurich, are the structurally dominant global cities, followed by Miami, Los Angeles, Hong Kong, and Singapore as "gateway" cities linked to distinct economic zones. Shin and Timberlake (2000) use the network analysis of about 100 cities at six time points (three to five year intervals from 1977 to 1997) to describe the changing role of key Asian cities in the global city hierarchy. This analysis shows the remarkable rise of key Asian cities in that network. Seoul (rising from lower than 20th place in 1977 to 12th in 1997) and Hong Kong (13th to 9th) made particularly dramatic gains, and Asian cities increased their share of total share of world city air passenger travel (in arrivals) from 15% in 1977 to more than 33% in 1997, even as total air passenger travel increased almost twelve-fold (see also Smith and Timberlake, 2002).

World Cities, Globalization, and the World-System. As one of the early proponents of "urban political economy," John Walton (1979) called for the analysis of "distinctive vertically integrated processes passing through a network from the international level to the urban hinterland" (164). This challenges us to figure out how the world city system "articulates" with other global networks, in particular, how can it be conceived as a hierarchy "nested" with broader structures of the world-economy? Research on "peripheral urbanization" (e.g. Kentor 1981) or "dependent" cities (Smith 1987) assumed that a locale's global economic position helped define urban dynamics; more recent literature argues that world cities assume "command and control" functions over the global economy (Sassen 1991). Understanding how "linked cities" fit into other sorts of "global circuits" (Sassen 2002) takes on a new conceptual importance today with the burgeoning debates about "globalization." Of course, globalization means many different

things to different people (for a discussion, see Smith, Solinger and Topik 1999). But clearly one of the most important claims that some scholars make is that recent worldwide changes have greatly diminished the role of nation states as the basic units of analysis and key actors on the global stage (Strange 1996, Rodrik 1997). (Ironically, these "decline of the state" claims are a dramatic "about face" from an increasing appreciation of the role of states, particularly as "motors of development" in places like East Asia (e.g., Appelbaum and Henderson 1992). Castells' image of a rising "network society" (1996) suggests that matrices of information flows are becoming much more crucial than the mosaic of places (where states were the key actors) – and he argues that "the most direct illustration" of this is the world city network (415). James Mittelman (2000) claims that globalization is "a historical transformation... such that the locus of power gradually shifts in varying proportions above and below the territorial state" (6). More subtly, McMichael (2000: Chapter 5) argues that "the globalization project" emphasizes the dominant role of the world market and changes the role of nation states so they are less concerned with "managing the national household" and increasingly preoccupied with "global positioning" and world competitiveness. The themes of "denationalization" and "deterritorialization" also resonate in recent writings of leading urban scholars (Sassen 2002; Taylor, Walker and Beaverstock 2002; Taylor 2003). Taylor claims there is a fundamental need to "recast" our analysis of the contemporary world-system itself, moving city networks to the center in a reformulated "metageography" of globalization (Taylor 2003). The research we propose here can help us get beyond abstract debates by allowing us to empirically examine the overlap and articulation of the relationally-derived world city hierarchy with a network conceptualization of the inter-***national*** economy (using data on global commodity flows between countries), as well as compare our image of the world city system with some alternative formulations of globalization and world cities (see discussion of the GaWC Project, below). Thus, we will explicitly evaluate some of the claims of globalization theory relative to the deterritorialization of the state.

Central hypotheses of this research. Five broad questions orient the research, guiding the data collection and analysis:

1. Global Network of Cities. On the basis of network relations among world cities, how can we describe the world city system hierarchy over the past 25 years?
   Hypothesis 1: There is an identifiable hierarchical world-system of cities evident on the basis of relations among them, with some cities residing near the top of this hierarchy representing central nodes in this system, others with less central locations but nevertheless well-integrated with the system, and still others appearing to be relatively isolated from the network.

2. Globalization, Global Integration, and Global Competition. Is there general support for the claim that as globalization has intensified, more areas of the globe have been pulled into a competitive, and therefore, increasingly hierarchical world order? How has the world city network changed, both in terms of the degree of hierarchy and the relative positions of particular cities in this hierarchy?
   Hypothesis 2a. Over the last 25 years, the system of world cities has become more hierarchical, particularly among the second tier of cities.
   Hypothesis 2b. Asian cities will be seen to have become more integrated into the world system of cities, with a few Asian cities rising dramatically in the global city system hierarchy.
   Hypothesis 2c. Over time, increasingly fewer cities will now appear as network "isolates" with respect to the world system of cities than twenty-five years ago.

3. How does the network of world cities overlay and articulate with the inter-***national***

world-system? Is there support for the "deterritorialization of the state" argument suggesting that states will have less influence over their own territories?

Hypothesis 3. Articulation of the world city system with the world system of nation states is strong but growing weaker over the 25 years to be studied. Though the structural position of particular cities will largely mirror the relative positions of the countries in which they are located, this will be true only for the leading cities in each country and it will be less true even for them now than twenty-five years ago. The reason why the leading cities will be somewhat less likely to mirror the hierarchical positions of the countries in which they are situated is related to "globalization" and the "denationalization of the state" (McMichael, 2000) which has weakened the political hold nations have over transnational firms which are city-based. Cities' relative standing in the world-system of places is thus increasingly likely to reflect their importance as nodes for world commerce and business rather than reflecting the geopolitical status of the nation in which they are situated. Particularly at the top of the global city hierarchy, we expect that the city network-national state network has become increasingly distinct and disarticulated. Thus, we expect to find the prominence of cities like London, Paris and Tokyo to increasingly transcend that of their nation-states.

4. How are various characteristics of cities themselves, such as internal inequality or economic dynamism, related to their (changing) locations in the world city networks?

Hypothesis 4a. There will be evidence of increasing social inequality across all cities in the system over the twenty-five years. This is predicted on the basis of the claim by proponents of the globalization thesis of growing world inequality, related to the "globalization gone too far" (Rodrik 1997) and the reduction of "social safety nets" formerly provided by nation states.

Hypothesis 4b. However, proponents of the global city approach argue that polarization is more intense in these centers, despite the fact that these places are also disproportionate loci of wealth and economic dynamism (Sassen 1991, 2001). Cities near the top of the global hierarchy are characterized by more social inequality than those at the middle and the bottom, and social inequality increases as cities' relative standing in the global hierarchy increases. This double-barreled hypothesis follows from Sassen's argument (2001) that the global control and command centers demand greater social inequality as transnational elites and their coterie of high-paid transnational producer service professionals create demand for low-paid personal services and immigration from low income countries. But this claim is countered by those who argue that the policies of individual states are far more influential in shaping patterns of economic growth and inequality than the global cities literature suggests (e.g., Hill and Kim, 2000; Hill and Fujita, 2003).

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Two topics are presented as questions for technical specialists. 1. The fusion of the several world systems of the past into the solitary contemporary global world-system invites display by means of graphic software, suitable for hydrographic diagramming; does such currently exist, or could it readily be created? 2. The sequences of power structures exhibited by past world systems are not very consistent with most standard expectations; new hypotheses are needed (network analysis might provide some). Do time-series analytical techniques (e.g. Zipfian, Shannonian, volatility) have insights of value to offer?

The Globalization of the World Systems with Sequences of their Power Structures

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Presentation to a
Specialist Workshop on

Globalization in the World-System:
Mapping Change over Time

Institute for Research on World-Systems
University of California, Riverside
February 7-8, 2004

My responsibility for this workshop is to prepare a short paper on a substantive topic that invites (a) visualization by technical methods of mapping temporal evolution, and/or (b) time-series analysis.

I propose to do this by showing the group some data which I have collected, presented and analyzed in fairly straightforward ways, but which seem to me to beg for more sophisticated methods than I am ready, willing and able to apply, since my commitments for the near future lie more in the making of new data than in the exploitation of what has already been collected.

I have for some years been working on developing data and, to a much lesser extent, testing theory concerning the political structures, the power configurations, of civilizations or "world systems," exploring typologies for such structures, locating the sequences of such configurations over very long durations, developing and testing hypotheses about the expected succession of such sequences.

I have elected two topics for this workshop: the globalization of the world systems, and the sequences of their power structures. Both topics have associated datasets. The data on first topic--the spatial and temporal paths which the several autonomous civilizations or world systems of the past took as they grew, collided, and fused to become the single world system of today's global civilization--seems to me to demand better visualization

immediately, but then will need considerably more data before it invites technical analysis.

The data on the second topic--the sequences of power configurations within the several world systems of the distant past, and within the single world system of the present and the recent past--seem to me, on the contrary, to beg technical analysis, though they too might be usefully re-visualized.

At this point let me draw your attention to Figure 1.

Figure 1, "The Incorporation of Twelve Civilizations into One"

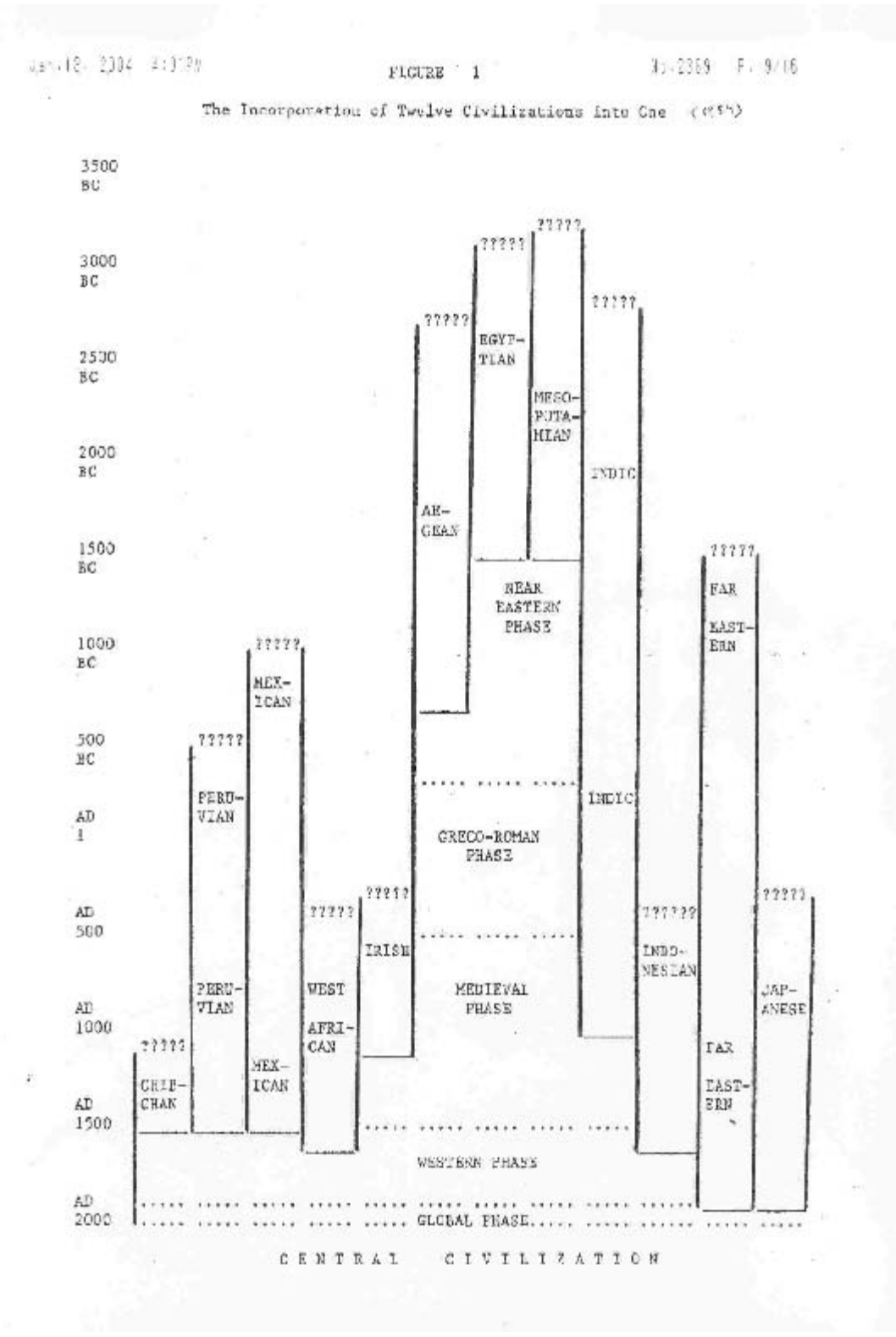


Figure 1 dates from 1984 and the era of the typewriter; it is

a software-free time chart which begins at the top of the page. As one goes down the page and forward in time, civilizations or world systems come into existence at various moments in time and points in space, coexist for some duration, then merge into larger entities.

While this figure shows with reasonable clarity what is meant by the merging of many systems into one, it has certain deficiencies which a superior graphing software could perhaps correct.

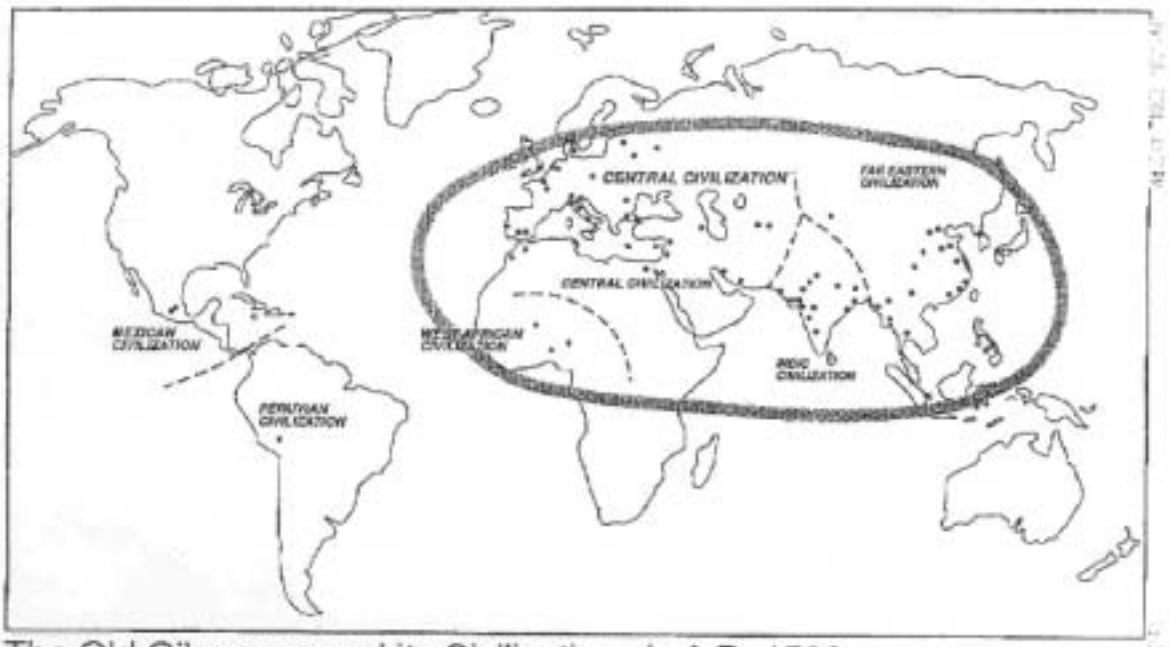
(1) All column sizes are the same, in some sense suggesting equal sizes for all systems at all times except the merged Central system. This is of course not the case, whether we speak of size in terms of area, of population, or of city numbers. This deficiency can be obviated when and if the changing sizes of civilizations could be easily graphed by software which would input a number and turn it into a columnar width.

The input might be, e.g., the number of large cities, or the civilizational area in square miles, or a population estimate for the whole civilization--more likely logarithmic magnitudes for both the latter, to hedge against pseudoprecision, or city numbers).

Preliminary data for such input exist, or could perhaps be derived via GIS. A representation of such extant data will be found in Figure 2, which locates, names and assigns to their respective civilizations or world systems 75 cities of the year AD 1500.

_____

Figure 2, "The Old Oikumene and its Civilizations in A.D. 1500"



The Old Oikumene and its Civilizations in A.D. 1500

= Area Within the Old Oikumene

+ = Largest 75 cities, 50 thousand +, derived from Chandler's list (1987) via Wilkinson (1992, 1993).

(2) The columns of Figure 1 are immediately adjacent to one another, suggesting that systems were so adjacent and in touch throughout their durations. This is not the case: the civilizations grew in space, threw out penumbras of trade nets, and were increasingly interrelated until they merged. If some measure of separation or interrelationship (as for instance distance between semiperipheral cities, or number of goods-types known to be traded at a given moment) could be incorporated into a graphic, we could see these entities approach one another over the interval before they merged.

(3) The chart is two-dimensional, and since time is included the north-south spatial dimension is simply ignored, and systems arranged on an east-west dimension, placing say Ireland and Mali as neighbors. If time is to be retained, and a north-south separation included, the graphic will have either to be a hologram or a fairly sophisticated two-dimensional representation.

This is the problem, for me, of the visualization of globalization. I have looked for software which might solve at least the first two problems, in what seemed to me the logical place, namely software for mapping or diagramming river systems, since river basins commonly show streams of different width and changing separation merging in space, which is at least analogous to world systems merging over time. But I have found no simple application that does what I think needs doing, and while there may be complex software that could be put to service, it seems wasteful to learn to pilot a 747 just to make the trip to the corner 7-11.

So here's my first challenge to the technical side: can you find or fabricate graphic software that will allow a superior diagramming of the growth and merger of world systems, by taking numerical input representing the sizes of such systems, and the separations of pairs of such systems at given moments, and interpolating values between the moments? Maybe yes, maybe no; it would be good to know either way.

My second problem has to do with the representation and analysis of the power configurations or political structures of world systems at different moments in their careers. For a preliminary look at what I mean, please examine Figure 3, again from the typewriter era.

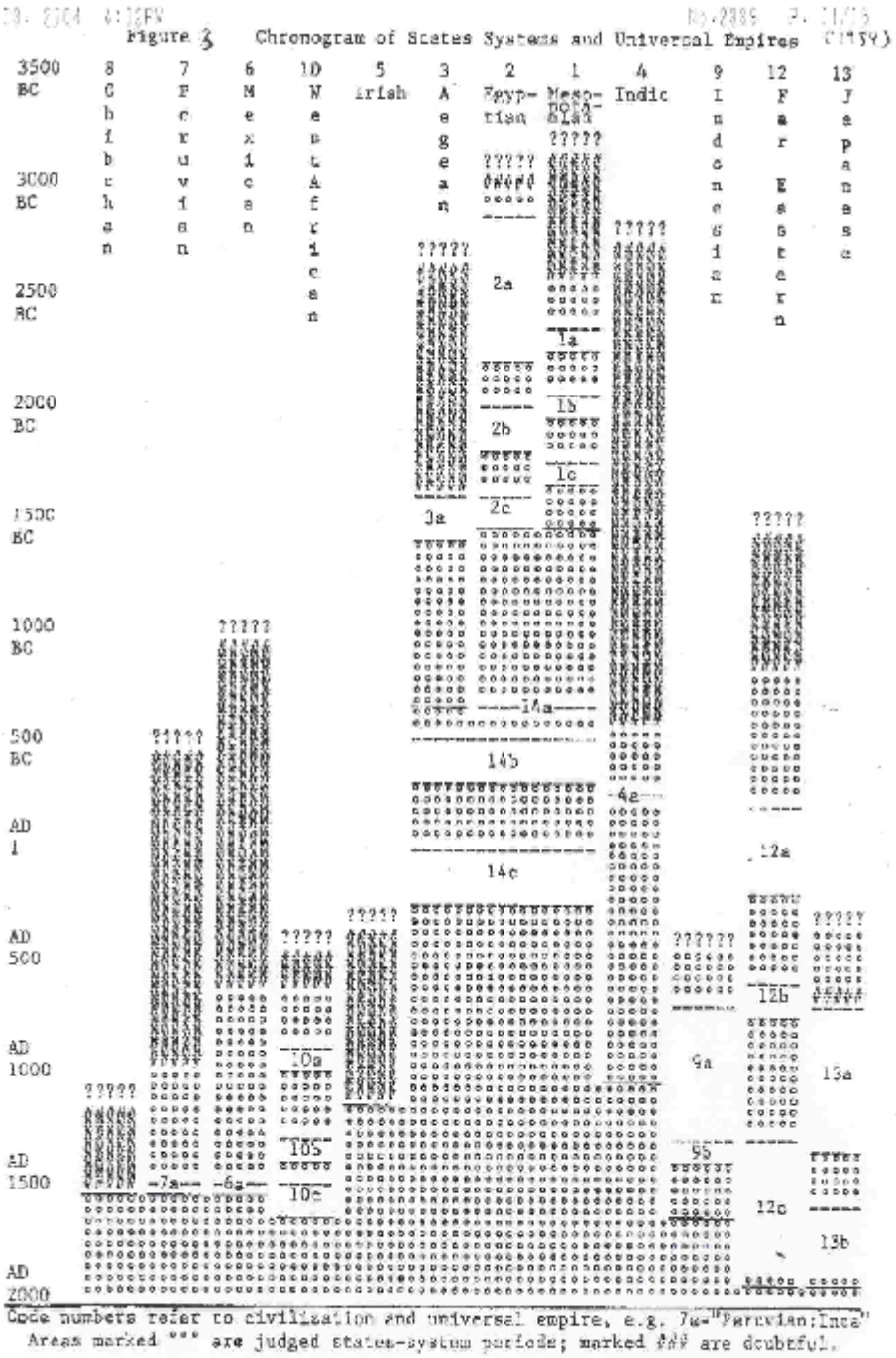


Figure 3 overlays Figure 1 with shadings. The shaded and unshaded areas represent values of a nominal variable treated here as dichotomous, two possible political conditions for a world

system: centralization vs. decentralization; universal empire vs. systems of independent states. The variable is an important one theoretically, concerning which there have existed various hypotheses, usually expecting increasing centralization over time, hence a preponderance of circle-shadings toward the top and of unshaded areas toward the bottom. This graphic is useful for showing that this is not at all the case, and that the problem is more complex.

Since producing Figure 3, I have been attempting to deal with the obvious concern that a dichotomous variable--Empire vs. States System--underrepresents intriguing complexities of power structure. For the next step in data collection I elected to try a heptachotomy, a seven-valued nominal power configuration variable, which included configurations long of interest to political scientists and world-systems analysts: in addition to empire, I look for a weaker form of domination, namely hegemony; and among states-systems, I varied the number of great powers, distinguishing unipolarity (with one superpower, as in the world today) from bipolarity (as during the Cold War) from tripolarity (with three great powers), multipolarity (more than three great powers, as in the world system during say 1815-1945), and nonpolarity (no great powers but many small independent states).

Surveying the world systems on this much more complex variable is taking a long time, and I'm far from finishing even a first cut, but I have some results. I provide a sample of these results as Figures 4-7.

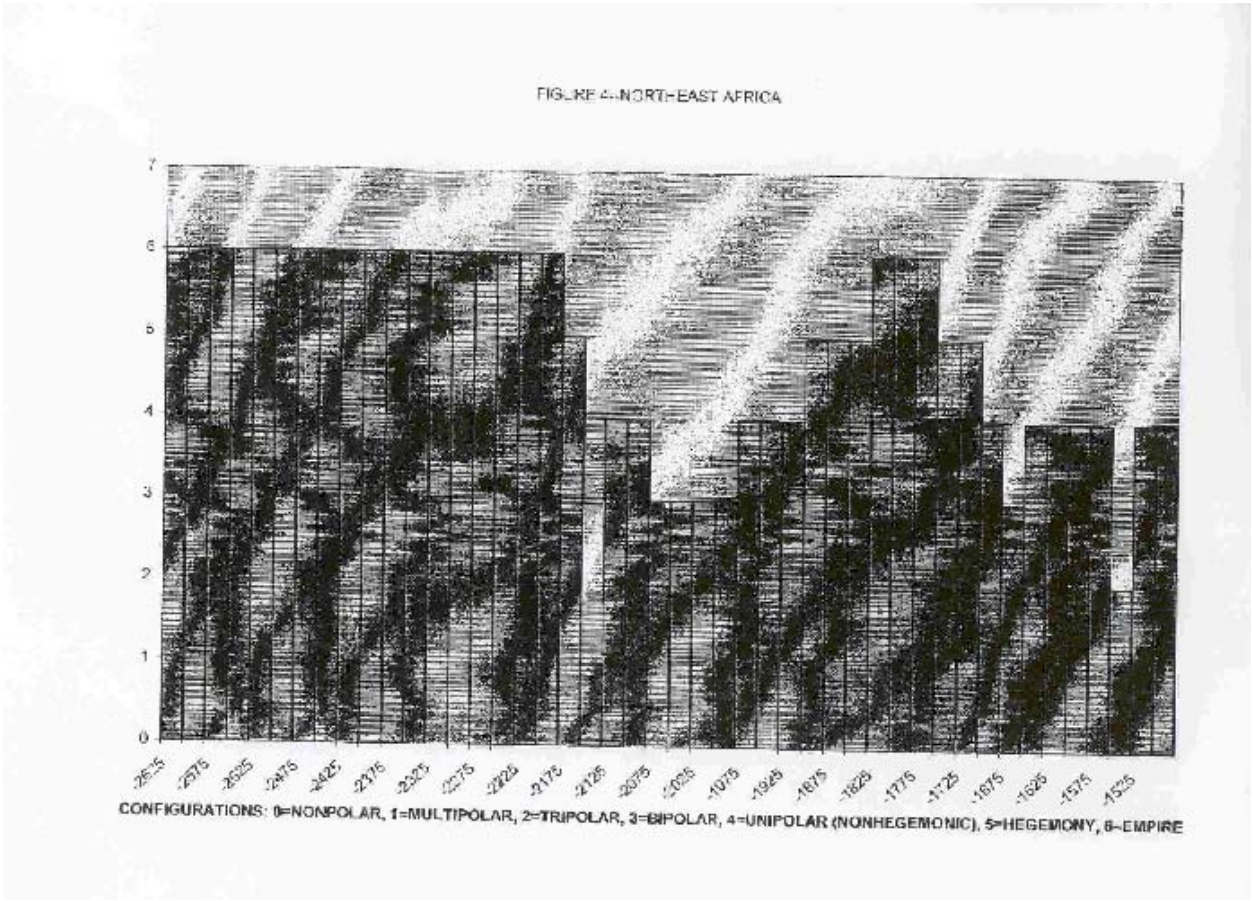


FIGURE 4--NORTH-EAST AFRICA
7
6
5
4
3
2
1
0
2675
2575
2525
2475
2425
2375
2325
2275
2225
2175
2125
2075
2025
1975
1925
1875
1825
1775
1725
1675
1625
1575
1525
CONFIGURATIONS: 0=NONPOLAR, 1=MULTIPOLAR, 2=TRIPOLAR, 3=BIPOLAR, 4=UNIPOLAR (NONHEGEMONIC), 5=HEGEMONY, 6=EMPIRE

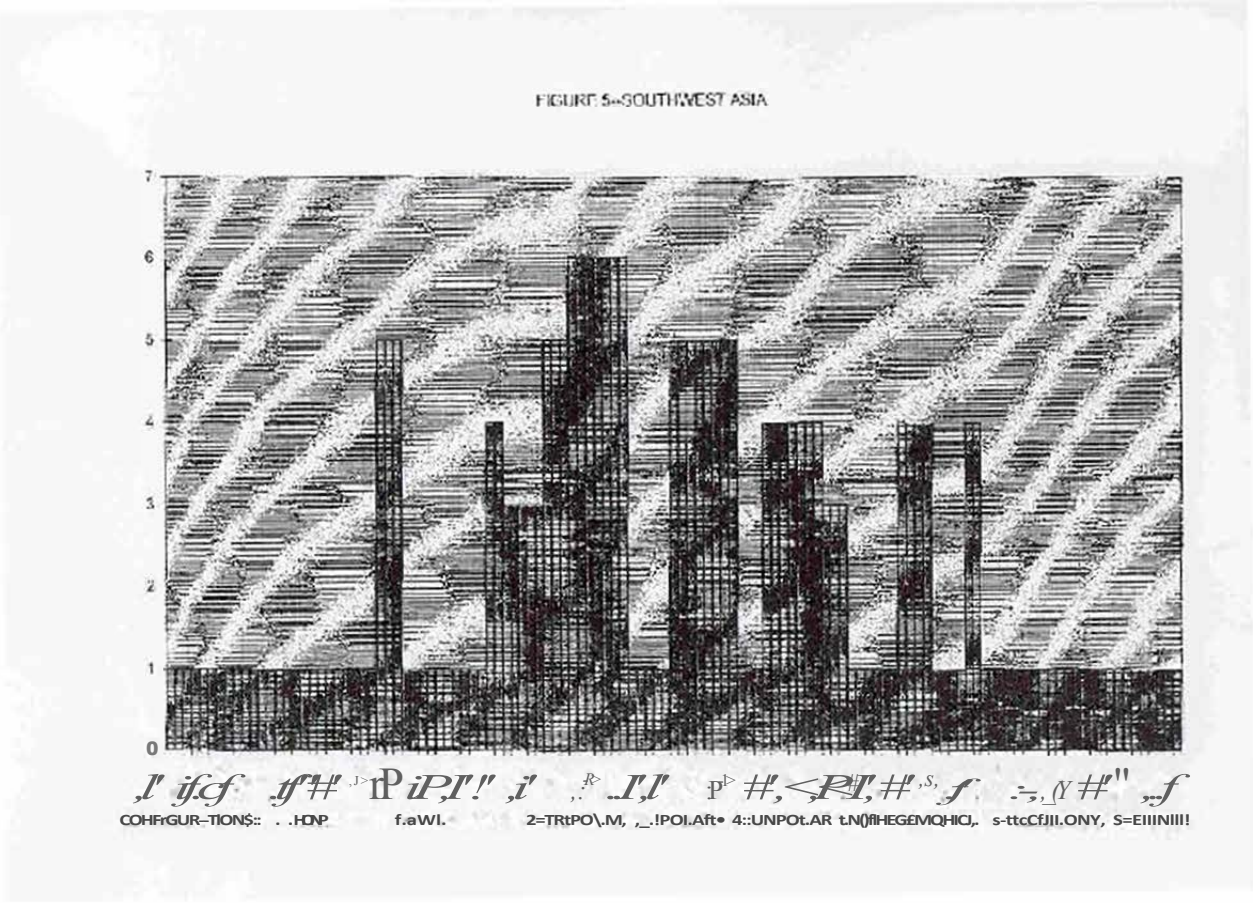


FIGURE 5--SOUTHWEST ASIA
7
6
5
4
3
2
1
0

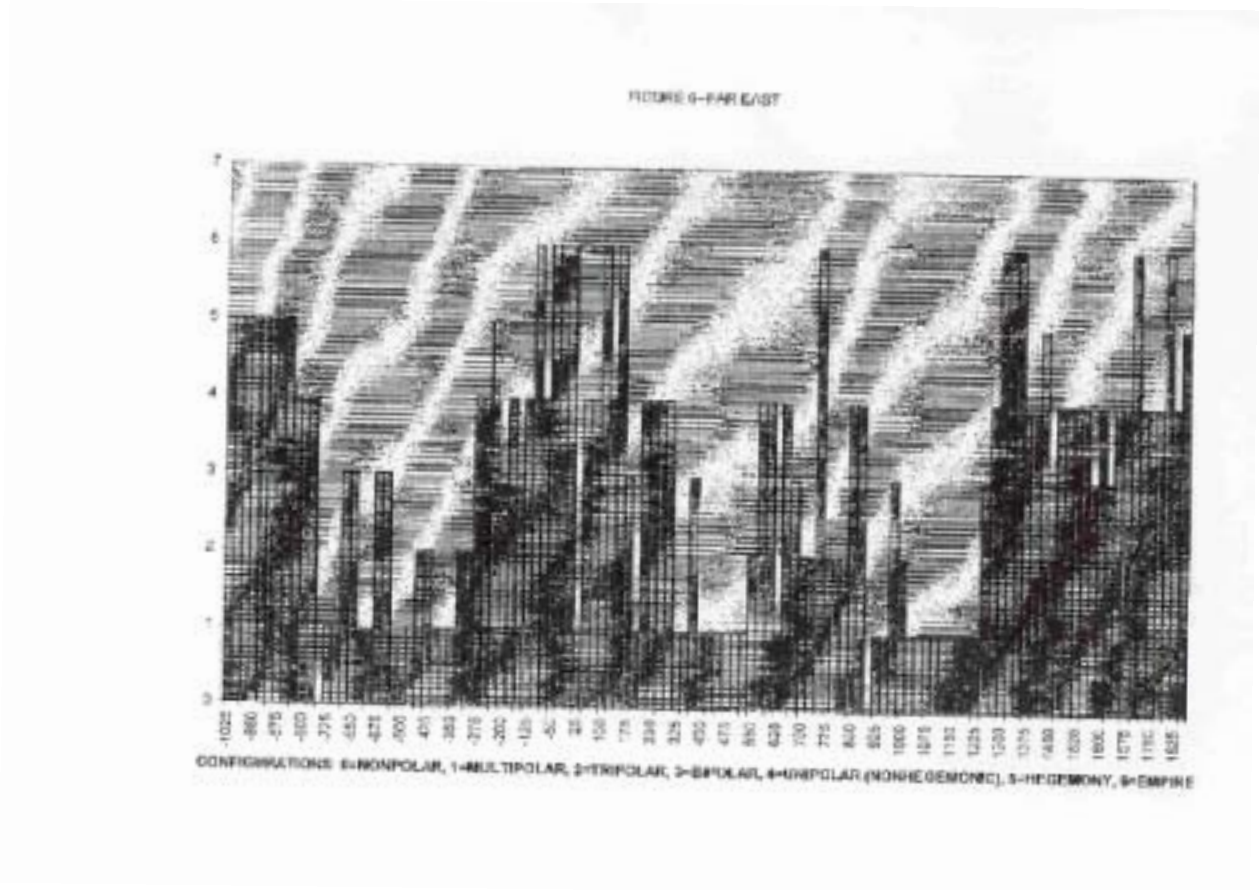
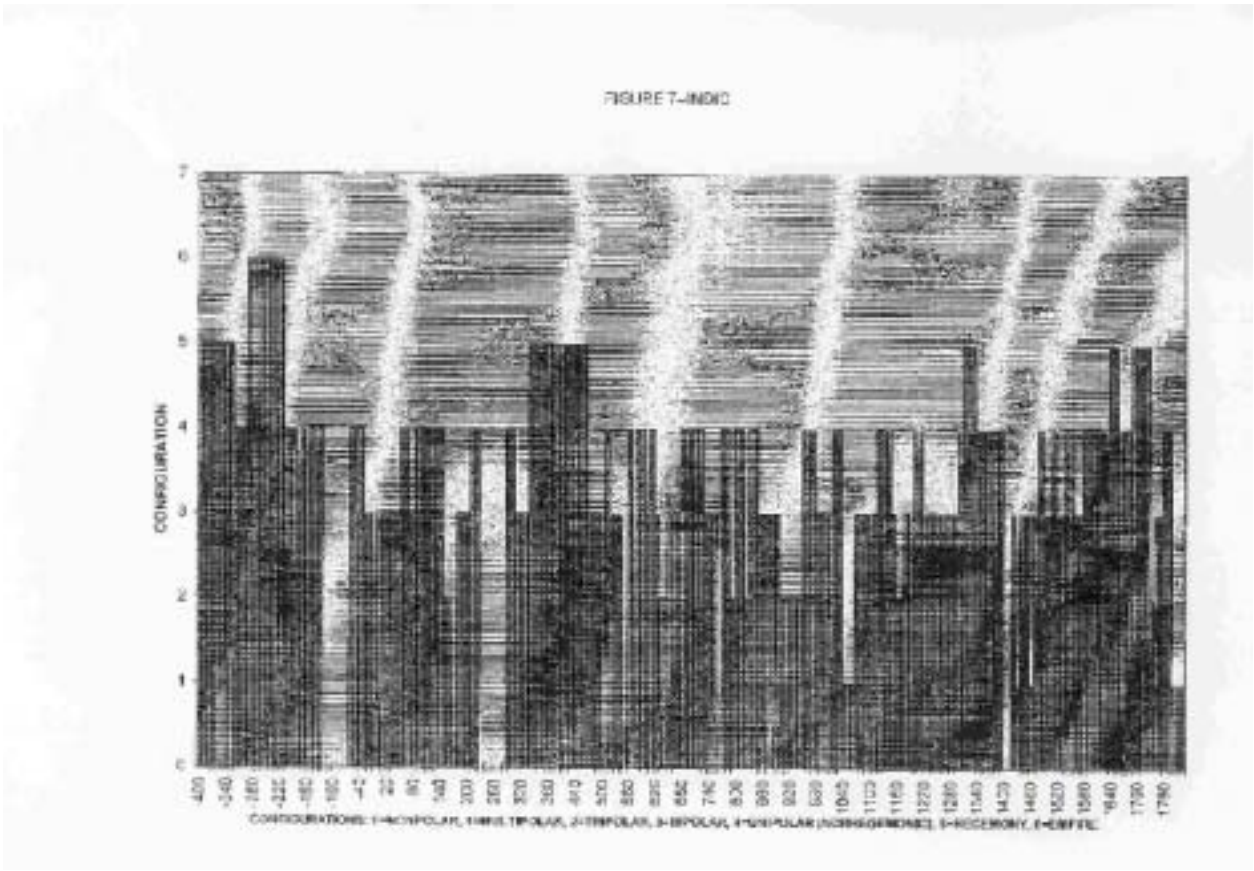


FIGURE 6–FAR EAST
7
6
5
4
3
2
1
0
CONFIGURATIONS: 0=NONPOLAR, 1=MULTIPOLAR, 2=TRIPOLAR, 3=BIPOLAR, 4=UNIPOLAR (NONHEGEMONIC), 5=HEGEMONY, 6=EMPIRE



As will be obvious, there is some orderliness here, yet no supreme pattern leaps out at you. So what will be needed is an analysis that tests one hypothesis after another, and builds new ones partly upon the ways and directions in which rejected hypotheses fail, as demonstrated for instance in L.F. Richardson's analysis of the complexity of wars.

Let me state some of the simpler hypotheses which float about the environment, sometimes compatibly with, sometimes contradicting one another.

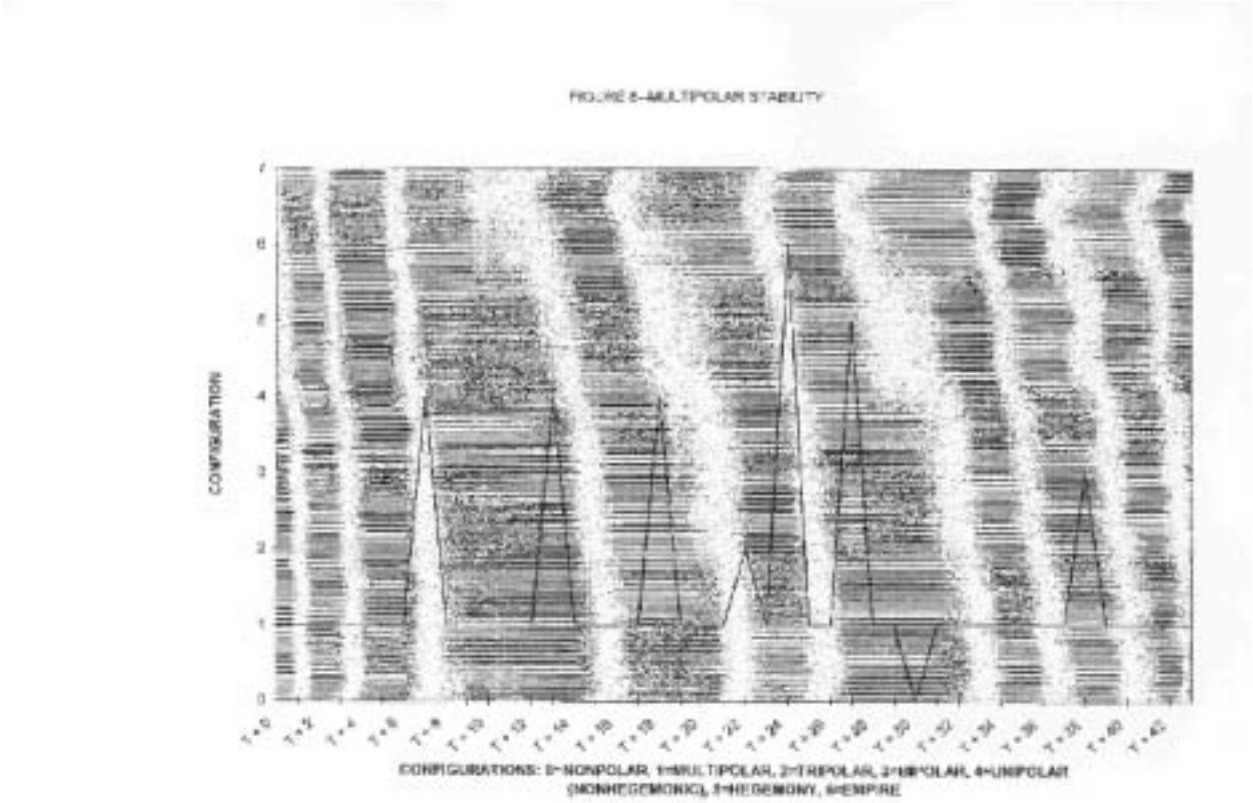
(1) Systems increase in centralization as they age.
(2) Systems tend to increase in centralization over time, but there are strong short-duration fluctuations enroute.

The data graphed in Figures 4-7 are not at all consistent with either (1) or (2), which reflect the civilizational ideas of Spengler, Toynbee (original) and Melko.

(3) Multipolarity is the norm.
(4) Multipolarity is the stablest configuration.

The notion that multipolarity is the stable norm is represented in an idealized way in Figure 8. Although multipolarism is widely approved by contemporary politicians, it is fairly consistent with only one graph (Figure 5, SW Asia), and even there there are long failure epochs.

Figure 8, "Multipolar Stability"



(5) Empire is the stablest configuration.

No doubt approved by Sons of Heaven, Caesars and Pharaohs, and certainly by Dante Alighieri, what we might call ultra-imperialism is reasonably consistent with one graph (Figure 4, Northeast Africa), but not the rest.

(6) Bipolarity is more stable than multipolarity.

Particularly identified with Kenneth Waltz, this hypothesis is inconsistent with one graph (Figure 6, Far East), not inconsistent with two graphs (Figures 5, SW Asia, and 7, Indic), and probably

not adequately tested in the fourth (Figure 4, Northeast Africa).

(7) Systems begin maximally decentralized, then endure long cycles of increasing and decreasing centralization.

This, the weakest hypothesis of the set, identifiable with the late work of Toynbee (Reconsiderations), seems broadly consistent with all but one graph (Figure 4, Northeast African); still, one would like to know more.

Based on visual inspection of the data, I have elaborated a few more that seem worth a try, and will require more careful testing than the simple, straightforward optical analysis just employed. Two are derivable from ancient and early modern physics, as well as from bureaucratic experience.

(8) Systems are Newtonian-physical, or conservative, and will most likely be found at any time in the same configuration they showed at the time of last measurement.

(9) Systems are Aristotelian-physical, or reactionary, and will most likely be found at any time in the configuration they have occupied for most of their duration.

Another hypothesis might emerge from common network analysis. Two network types seem to have parallels in the power configurations. "Random" networks, with nodes linked at random, lack such a parallel. "Regular" networks, with neighbors highly interconnected, best approximate the Nonpolar configuration. "Scale-free" networks, with a small number of highly connected nodes and a large number of weakly connected nodes, are represented by the other six configurations, with Empire having the smallest number of highly connected nodes, Multipolarity the largest.

(10) A relevant hypothesis might then be: the bigger they are, the harder they fall. A chance of large cascading failures seems inherent in highly interconnected systems when they are stressed: perhaps then transitions out of the Empire configuration will tend toward greater decentralization than those out of the less-connected Hegemony and Unipolarity configurations.

At this point I will stop posing hypotheses and start asking questions, to which I hope somebody in the audience will have answers that may either propose additional hypotheses or means of measurement.

(11) To what extent do these world systems behave according to Zipf's Law? If for each of them we calculate the frequency of occurrence of each of the seven configurations, then logarithmically plot the frequencies in descending order, to the degree that the slope of the plot approximates -1 (vs. 0), the curve may be a "signal" containing information and implying complexity of the underlying system. (A 0 slope would be noise, a signal with no information, attributable to chance.) Zipfian behavior would to some extent seem consistent with "traditionalism," in that the more often a behavior (configuration) was displayed in the past, the more often it would be predicted to occur. But is there more to it than that?

(12) Discussion of Zipfian patterns leads to introducing the--at least to me--difficult notion of Shannon entropy. Verbal descriptions of Shannon entropy, with whose mathematics I am unfamiliar, inform me that zero-order Shannon entropy measures the diversity of a repertoire: in this case, a world system's repertoire would be the number of configurations which are actually displayed by that world system over time. For instance, the repertoire of Northeast Africa excluded nonpolarity, as did that of Southwest asia, which also omitted tripolarity, while all seven configurations appear in the Far eastern and Indic timelines.

First-order Shannon entropy measures the frequency or probability of occurrence of each element in the repertoire. Second-order entropy is a conditional probability: knowing an item in a sequence of configurations, what are the chances of predicting the next item? The third-order entropy value is the probability of predicting the third configuration in a sequence, given the first two. Higher entropy values at given orders, and non-zero high-order Shannon entropies, imply a higher degree of predictability, regularity and form in the whole system.

It might be of interest to calculate the Shannon entropies of the various world systems, and to attempt to interpret them.

(13) It would appear by inspection that the volatility (variance) of power configurations changes over time--compare the first and second halves of the Figure 4 timeline--and perhaps therefore also their Zipfianness and Shannon entropy do so as well. Do any particular configurations or sequences predict higher or lower volatility? But what is an appropriate measure of volatility in a nominal variable?

Hypotheses 8-10, and topics 11-13, I don't feel prepared to

undertake alone; I have more pressing business in the datamaking area. Like the task of improving the graphics of Figures 1 and 3, they need more sophisticated tools than I currently possess, which leads me to a search for someone better able than I to deploy same. So my objective at this meeting is to find a collaborator or two who is equipped to rapidly process these data, and other data in the making now, exploring for Zipfianness, Shannon entropy, volatility variation etc., and jointly analyze the findings, and/or to provide superior and more suggestive graphic displays for existins data.

CIVILIZATION/WORLD SYSTEM
POWER CONFIGURATIONS

PHASE I: TWO CONFIGURATIONS

UNIVERSAL EMPIRE
STATES SYSTEM

PHASE II: SEVEN CONFIGURATIONS

EMPIRE
HEGEMONY
UNIPOLARITY
BIPOLARITY
TRIPOLARITY
MULTIPOLARITY
NONPOLARITY

Zhiqian Yu, Software Engineer, ESRI, Redlands

There are formation rules in each complex system in the nature. In this paper, two such rules are applied to analyzing how location of ancient empires is affected by technology and nature factors, such as temperature, precipitation, slope, in the agricultural Age. GIS is used to model the spatial distribution of ancient kingdoms.

University of California Riverside
and
University of California Santa Barbara

Specialist meeting on "Globalization in the World-System: Mapping Change Over Time"

http://www.irows.ucr.edu/conferences/globgis/globgishomepage.htm

The workshop's five topical sessions will be on:

- Commodity Chains and Labor in the World Economy
- Global Business Networks
- Global City Systems
- Hegemony and Power Configurations in Interstate Systems, and
- Global Transportation and Communication Networks

Organizers:
Richard Appelbaum, Christopher Chase-Dunn and Helen Couclelis
Co-sponsored by:
Center for the Spatially Integrated Social Sciences at the University of California, Santa Barbara
And at University of California, Riverside:
Office of the Vice Chancellor for Research, Office of the Chancellor, Institute for Research on World-Systems and Program on Global Studies

This workshop will bring together twenty-six scholars with a substantive or methodological interest in the study of global-scale socioeconomic processes across time and space. The group will be composed of empirically oriented scholars of global social processes and several experts on geographic information science and network analysis. The purpose of the workshop is to encourage participants to develop ideas for research projects on the structure and dynamics of globalization using new research technologies such as Geographic Information Systems (GIS), spatial analysis methods (including network analysis), and sources of geographic information not usually employed by globalization researchers. Geologists, climatologists and other earth scientists have long used GIS and related methods along with geocoded data at the global scale, but social-science work on globalization phenomena that explicitly utilizes such methods is still quite rare. This workshop will bring researchers together to help generate ideas for new globalization research projects that make use of GIS methods, spatial analysis including formal network analysis, and scientific visualization techniques such as "time-mapping."

Welcome by:
UCR Chancellor France Cordova

Keynote Address by:
Michael Goodchild, CSISS Director
"Spatial Perspectives for the Globe"
Saturday, February 7, 8:30-9:45 am at the Anderson Graduate School of Management, Room 118, UCR * *Public Invited*

The Center for Spatially Integrated Social Sciences (**CSISS**) http://www.csiss.org/ recognizes the growing significance of space, spatiality, location, and place in social science research. It seeks to develop unrestricted access to tools and perspectives that will advance the spatial analytic capabilities of researchers throughout the social sciences. Located at the University of California at Santa Barbara, CSISS focuses on the methods, tools, techniques, software, data access, and other services needed to promote and facilitate a novel and integrating approach to social science that is *spatially integrated*. The National Science Foundation funds CSISS.

The Institute for Research on World-Systems (**IROWS**) http://www.irows.ucr.edu/ organizes collaborative research among social, biological and physical scientists on long-term, large scale social change and its ecological, geographical and epidemiological causes and effects. Located at the University of California at Riverside, IROWS pursues comparative research on the rise and fall of civilizations, long-term processes of globalization and climate change.

Saturday February 7 and Sunday February 8, 2004