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# The Effect of Network Structure on the Provision of Security

Paper to be presented at ISSS/ISAC Conference  
October 15, 2010 Providence, Rhode Island

Draft: comments welcome

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## Abstract:

The term “security” has many more dimensions in the post-9/11 world than it had during the Cold War. Threats may come from different sources, at different speeds, and have different targets. All the actors involved in the provision of security from a specific type of threat create a network—not just states or states in intergovernmental organizations, but all the actors in the “ecosystem.” If we look at the relationships among these actors using network analysis, we should be able to map the structure of the entire network. Contrary to the assumptions in most International Relations literature, networks can be centralized (as in hierarchical states) or not, as in markets. The networks transnational actors have created to meet different threats exhibit different structures, from dense and highly centralized to diffuse and dispersed. The network’s structure may thus have a positive or negative effect on the provision of security, depending on the type of threat that is to be met.

*The Jeweled Net of Indra*

*Driving down the freeway, remembering Hindu mythology—  
Indra's net, each intersecting weave holding a jewel  
reflecting every other facet of every other jewel, infinitely.  
Suddenly, I see the hands that paint the white lines,  
that lay the black asphalt, hands of a man joyous or lost  
soap-scrubbing his body clean for dinner and beer,  
for the wife who loves him, hands that hold their tickets  
for London to see the grandmother, the hard-drinking  
pub matron whose body bore children in building rubble  
when the Nazi bombing relented—and if not for that war,  
would I be driving now, hands on the wheel, listening  
to the radio recount the birth of the child named Tsunami  
after the storm that drove her mother into the hills,  
would the meager dollars I send to rebuild a village—  
minted with the Rosicrucian-eye above the pyramid  
dreamed by this country's founders as the all-seeing  
vision of a world where not a sparrow falls  
that we don't know about—would I have known  
to send it, if not for the hands that flew the kite  
that drew electricity from the skies that made its way  
into the flat-screened box that unveils this jewel-linked world  
twenty-four hours of every gleaming day, weaving news  
with advertisements for clothes made by hands in China  
nimble sewing a dream of Hollywood and Ipod and offering  
their bodies one by one for a better future—  
while the coal that fumes the electricity that plunges  
the needle drifts in air that circles a globe that warms  
the icecaps that melt into sea that shifts the current  
that loves the wind that swirls from heaven to earth  
stirring one storm after another, blowing  
its diaphanous passion over New Orleans like a trumpet  
sinking the heart so low with blue notes that flood  
is a dark cure for what burns—this illusion  
that anyone stands alone—stranded  
on the roofs of our swollen houses mouthing  
save me to a world whose millions of hands  
can turn up the volume loud enough to finally hear,  
or flick with a single click the entire interconnected  
vision of it all off.*

—Dane Cervine (2007)

What do a slice of Swiss cheese, a Magnetic Resonance Imaging (MRI) scan, and global governance have in common? The familiar cheese is a structure whose taste

remains unchanged but whose visual appearance changes by slicing in different directions—depending on the cut, the same holes appear different. An MRI takes finely detailed pictures of such heterogeneous structures as the human brain. Tiny two-dimensional slices are assembled to provide an extremely accurate three-dimensional depiction of complex reality, but any one slice provides only a partial picture that is accurate but can be misleading. The concept of global governance provides a description of the complex, heterogeneous structures of the connections and interactions in world politics, which can be studied by examining slices at different geographical, temporal, and issue junctures. At present, social scientists have knives to slice cheese but are grasping for tools to take MRI slides.

In ameliorating global governance theorizing, this paper examines first definitions of global governance and then the use of social network analysis to map the transactions between multiple actors—the most promising way to appreciate the partial and currently available slices of contemporary international relations. It continues with empirical examples of global security governance: international responses to the Indian Ocean tsunami of December 2004 and nuclear proliferation. It ends with a description of network strategies for governance and suggestions for a future research agenda.

## **Global Governance**

### *Definitions*

Global governance is too new a notion to be defined in many political science lexicons, or even in the *Oxford English Dictionary's* online edition. However, in its inaugural edition in 1995, the journal *Global Governance* contained definitional attempts by James N. Rosenau and Lawrence S. Finkelstein.

Rosenau, building on his life's work, writes that governance is concerned with the mechanisms of control (both trans-national and sub-national practices and institutions) that are essentially related to one another, and when taken together constitute systems of rule. He emphasizes the exponential growth of interdependence as actors proliferate to meet the new needs that are created. The existing world order remains without overarching authority, which does not mean that there is no structure: "Governance encompasses the activities of governments, but it also includes the many other channels through which 'commands' flow in the form of goals framed, directives issued, and policies pursued" (Rosenau 1995:14). There is no global ordering principle, but global governance is usefully seen as the sum of the formal and informal mechanisms that ensure partial ordering—what Rosenau poetically calls a "crazy quilt."

Finkelstein wrote that "global" denotes a world in which actors other than states play an increasingly important role, and in which decision-making processes are multilevel, connected both within and between states. "Governance" is an ambiguous term that refers to governing without government, the title of Rosenau and Ernst Czempiel's earlier set of influential essays (Rosenau and Czempiel 1992). "Global governance," for Finkelstein, is "any purposeful activity intended to 'control' or

influence someone else that either occurs in the arena occupied by nations or, occurring at other levels, projects influence into that arena.” It is a process of activity, and to differentiate it from other terms, its descriptive rather than normative nature should be emphasized: “global governance is governing, without sovereign authority, relationships that transcend national frontiers” (Finkelstein 1995:368-9).

More recently, Anne Mette Kjaer examined the term “governance” and its usage in different fields of political science including comparative politics, international relations, and public administration policy. She found that most definitions refer to something broader than government alone: to the “steering” and rules of the game as well as to institutions and institutional change. Increasing use of the same term among fields, in her opinion, reflects the erosion of boundaries. All versions address the importance of networks, of reciprocity, accountability, and democracy.

However, different fields are addressing different problems, and the views of global governance held in international relations vary strongly depending on whether or not contemporary globalization is seen as a transformation of economic, military, environmental, and socio-cultural interactions. Theorists tend to fall in two camps: those who believe states are the most important actors, and those who do not. Neo-realists and pluralists (of the English school) believe that global governance is no more than what states agree, while solidarists look to the collective action of states in defense of human security as global governance. However, solidarists differ from neo-realists and pluralists in believing that globalization has been transformative. Finally, liberalists believe that not only are many global governance processes underway at subnational, national, and supranational levels, but that the regimes thus created are likely to be flat non-hierarchical networks with no one actor in clear control. Thus, for them, global governance refers to the totality of all regimes (Kjaer 2004).

“Global governance” does not denote good or bad practice but describes cooperative problem-solving arrangements. They may be formal, taking the shape of laws or institutions to manage collective affairs by such actors as state authorities, IGOs, NGOs, private sector firms, other civil society actors, and individuals. But arrangements may also involve such informal mechanisms as practices or guidelines or even temporary units (e.g., coalitions). Global governance includes purpose-built regimes as well as market-driven evolutions and adaptations.

This author agrees with Thakur and Weiss that global governance is “the complex of formal and informal institutions, mechanisms, relationships, and processes between and among states, markets, citizens and organizations, both inter- and non-governmental, through which collective interests on the global plane are articulated, rights and obligations are established, and differences are mediated” (Thakur and Weiss 2010). This definition emphasizes five components that are essential for analyzing contemporary international relations: level of analysis (transnational); issues; non-state actors; the dynamics of governance; and the interdependent yet loosely-coupled complex international system.

### *Structure and agency*

Global governance is about understanding and creating structures through repeated relationships, or patterns of authority. It is a heuristic device that allows us to pay attention to a range of activities and actors in contemporary world politics. States remain the most important actors, but a host of other actors are increasingly crucial; and all of the actors in any case are interdependent. And interests are partly a result of an actor's attributes and identity, and partly of its structural role and position within the extant world order.

Collectivities are organized to achieve goals, and they draw on different sources of legitimacy. For example, a state is organized differently from a corporation, and for different purposes. A state has sovereignty, which provides an interest in defending a given territory. A corporation is organized to make a profit, which gives it an interest in certain people (its market). Global governance thus recognizes that human beings create many kinds of organizational structures that interact with one other and evolve constantly.

This is structure as the Gramscian idea of *historic bloc*: the superstructures formed by the unification of leaders and followers around a particular mode of production, and the social relations it engenders (Joll 1977, Sassoon 1987, Gramsci and Forgas 1988). In international relations, the "product" may be a process such as war, or it may be a service like humanitarian aid. *Hegemony*, then, is the point where the ideas that govern that product meets the class of actors that both supports the ideas and is supported by them.

In other words, the structural position of actors depends on the framing of an issue, or how it is categorized by actors that are paying attention to it. A state active in peace and security may not be as engaged on environmental issues, or the other way around—for example, Israel is active in security issues, but is not known for its stand on the environment, while Japan's involvement in security is not as well known as its activity in environmental issues. Or an NGO can have tremendous impact on rule-making but not on enforcement or the other way around—for instance, the International Campaign to Ban Landmines's lobbying led to a multilateral treaty, while Amnesty International's reporting and shaming have been effective at protecting human rights.

This framing of global governance allows us to pursue a constructivist research agenda that fits Jeffrey T. Checkel's criteria for building "middle-range theory," or efforts to link theory to reality. In essence, it consists of making one's ontology consistent with one's epistemology, and vice versa. Checkel seeks a constructivist theory that can test reality in comparison and in contradiction to theory; compare among cases; be used to study socially constructed outcomes that are negative and not just positive; and formulate standardized definitions (Checkel 1998).

### *Other schools of thought*

Realists study state vs. state behavior. Liberal institutionalists scrutinize state interactions with international institutions. Rather than placing constructivism in opposition to either, it is best viewed at the other end of a spectrum. The lessons from realism and liberal institutionalism are pertinent to explain actor behavior, but they are misleading or insufficient to understand the ever-changing behavior of the international system as a whole, and unexpected outcomes. That requires the sum of all such relationships.

Returning to Checkel's criteria, we need to look at multiple slices of global governance, investigating simultaneously as many different types of ties between and among actors as possible. We also need to examine the ties (or lack thereof) between different types of actors, and to study entire networks. To that end, I propose to look at how actors do or do not interact in global governance.

Not all MRI-like slices provide the same picture of the evolution in international society because the patterns of relationships and institutions vary by issue, geographic location, and historical period. For instance, calculations about international peace and security are not the same for major and minor powers, not similar for nuclear weapons and drugs, and not comparable before and after 9/11.

Global governance is often conducted by different types of actors, depending on an issue—for instance for international security, members of the US's 82<sup>nd</sup> Airborne Division (national armed forces) or UN peacekeepers (international armed forces). At the same time, actors that are *a priori* viewed as distinct may actually play similar roles—for example, soldiers or Oxfam personnel in a war zone may both be caring for or protecting refugees.

### **Using Social Network Analysis to Study Global Governance**

An ecological approach looks at the entire system of interactions, both among actors and between actors and environment. Global governance fits the definition of a complex system: multiple types of actors and processes, the structure of which is the result of past structure, actor choices, and stochastic processes. The modelling of such complex systems in international relations has its roots in sociology and English School international relations theory. It is greatly facilitated by the use of quantitative social network analysis methods, used to map broad trends and patterns, which can then be used as a basis for comparison, for finding “communities” of similar actors, and for investigations into dynamics. To demonstrate this, examples from a range of global security governance issues will be explored.

However, using social network analysis to study global governance requires careful examination of both ontology and epistemology, as the definitions and conceptions of what is to be studied are affected by the choice of a formal mathematical approach. In contrast to both realism and liberal institutionalism, which look at the pattern of interaction among the members of only one or two types of organization, the ecological approach assumes that all the organizations that demonstrate agency, or

choice, count as actors. These actors interact with each other and with their environment, which refers not just to the strictly material or ideal, but also to background trends such as globalization that do not exhibit agency. In this sense, it draws upon the heritage of English School theory (Bull 1977, Buzan 2004, Devlen et al. 2005, Hurrell 2007). This approach also means that the intellectual puzzles of researchers will change, as the questions become more oriented toward patterns of cooperation and cohesion, and less about the actions and motivations of individual actors, or of specific types of actors.

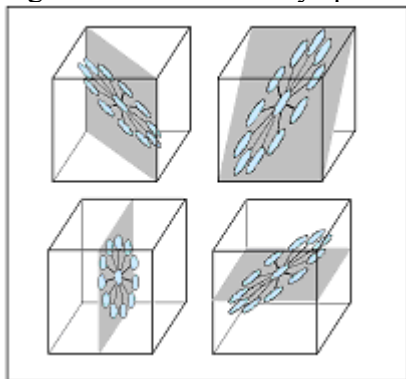
### *Slices of political space*

A graphic representation of political space would show the multiple dimensions in which issues can be mapped. The dimensions to be mapped may vary, but as an example, security could be mapped by asking these questions: “Where does the threat come from?” “What is the target of the threat?” “How fast does the threat move?” and “What is the severity of the threat?” These are spectra, or continuums, not dichotomous categories, and thus can be imagined as dimensional axes. Patterns of cooperation, or networks among actors, are different depending on where one looks on these dimensions.

An advantage of mapping along multiple dimensions is that no one position can be seen as a priori privileged. It also means that the space can be “questioned” by different lines of thought. For example, one could ask where the organizations that deal with the security of internally displaced persons (IDP) camps intersect with organizations that deal with human rights or more specifically women’s rights. This would help provide security to those most likely to face unique threats to their security while in the camps, not just the threat that the camp itself provides security from.

Take slices of this space by imagining Swiss cheese or an MRI: one slice may be a very misleading picture of the structure, but build up enough layers, and you start to get a 3-D object. If the networks are the slices, more than one slice can be studied. Some of these networks may have overlapping memberships, or intersections.

Fig. 1: Slices of security space



Capturing the complexity of the range of problems, actors, and partial solutions is a benefit of using global governance as an analytical perspective in understanding



international responses to events like the tsunami. But we are still at the Swiss cheese-level of precision, groping for tools for a few MRI-level slides. What could get us closer?

Social network analysis (SNA) is one promising methodology because it allows comparisons of the types of contours of structures and gaps that characterize international reactions to global problems. It provides a way to systematically study the structural properties of networks as well as the location and characteristics of actors within them; it uses mathematical representation in order to quantify empirical data and to model relations and structures and represent the results graphically. SNA allows the simultaneous consideration of multiple relationships—a major insight for the analysis of international relations, even when considering states let alone the multiple types of actors and layers of relationships that characterize contemporary global governance. The following section is meant as a basic introduction to the elements of SNA using comparative security networks for those who are totally unfamiliar with SNA. For a more thorough introduction, please see the article “Social network analysis: A methodological introduction,” by Carter Butts (2008), or the texts by Scott (1991), Wasserman and Faust (1994), or Knoke and Yang (2008).

The basic elements of SNA are actors, which are the social units, and relations, which are the ties between or among actors that are channels for the flow of resources (ties can be affiliations, as in members of the same club). There are three basic assumptions underlying social network analysis. First, we are dealing with relationships or connections and not merely static units. It is therefore not a method suited to studying units in isolation. Second, SNA assumes that social units are interdependent; their ties both enable and constrain actions. This also means that regular statistical methods have limited utility because actors are not independent and cannot be analyzed in isolation one from another. Third, SNA assumes that there are system-wide relational properties, and that the sum of such “enduring patterns of relations” constitutes the system’s structure.

Network terms can be translated into international relations via the measures of power in global governance described by Michael Barnett and Raymond Duvall. They divide types of power into a matrix with two core dimensions: the kinds of social relations through which power works, and the specificity of the social relations through which power’s effects are produced (Barnett and Duvall 2005). The first kind of power, familiar to realists, is compulsory power that represents direct control of one actor over another. This can be measured in network terms in many ways: as a regulatory relationship with one party making and enforcing rules, as a contractual relationship with an exchange of goods or services for payment, or a conflictual relationship with one party using violence against another.

Institutional power is more diffuse because actors exert control over others that are socially distant. Membership in an alliance, attendance at UN conferences and other types of affiliations are network relations that measure this type of power. Structural power represents the capacities of actors—in other words, what they are depends on where they are in the network. Finally, productive power is the production of subjects through the diffuse social relations of discursive practices. To paraphrase, an actor’s

“self” is a creation of discourse, or negotiation with and against multiple others. This can be measured longitudinally by process tracing that links diffusion of norms and ideas to actor constitution—that is, it is helpful to track the progress of an idea through the network, and then look for evidence that the actors’ identities have changed as a result.

This paper explores network "slices" of the cloud of actors involved in the governance of global security issues (for the purposes of demonstration, this paper looks at networks from different issue areas, but the concept applies to geographical and temporal slices as well). The networks I will be examining are two networks from a case study of a human security threat—the Indian Ocean tsunami, and two networks from a case study of a traditional security threat—the attempt to stem nuclear proliferation. This paper then maps the institutional and compulsory power relations in both human security (the tsunami) and traditional security (nuclear nonproliferation) networks.

The actors belong to different sets (because they are different types of organizations—states, NGOs, companies, etc.), but there are also connections among and between sets. On the basis of this theoretical framework, it should be possible to examine both clustering, or how closely connected actors are, and structural equivalence, or finding “communities” of actors with similar patterns of relations to the rest of the network.

### **Slices of Global Governance: Traditional and Human Security Networks**

Human security and traditional security are different but related hegemonic ideas that engender different but related historic blocs. International peace and security—whether the more expansive human security variety of protection against threats to individuals, or the more traditional “bombs and bullets” one of protection for national boundaries—has been viewed as the exclusive preserve of states (MacFarlane and Foong-Khong 2006). Protecting public health normally also is viewed as a state responsibility, and measures taken against the spread of disease have been among the most draconian (Kraut 1994). The state has also been responsible for infrastructure and its failure—which is why the Netherlands invested billions to hold back the North Sea and why the breach of levees in New Orleans was viewed as a government failure.

Dangers resulting from public health and infrastructure failure thus are viewed as threats to human security as well as to traditional sovereignty. The Indian Ocean tsunami of 26 December 2004 demonstrates global action to meet a security threat that transcended national borders. Analyzing it illustrates better the strengths and weaknesses of global governance—in theory and in practice—than pointing to the obvious lack of adequate political will or international military force to intervene in Darfur (Center for International Cooperation 2007).

The response to the Indian Ocean tsunami provides a microcosm of global governance and how a global problem is addressed in a decentralized world. The responses by a constellation of relief organizations, national governments, militaries, and private individuals around the world illustrate the strengths and weaknesses of global

governance. An overall response network (states, IGOs, and NGOs) was in place, but the creation of the tailored network for the tsunami required negotiating a structure among existing groups as well as procedures to incorporate others that joined later.

The provision of emergency supplies to affected populations was available almost immediately, reflecting a long-standing moral commitment to react quickly and generously in the face of natural disasters. As people in the affected regions began calling, texting, and uploading images and movies, massive relief began. In a natural disaster, the acceptance of outside humanitarian action was virtually automatic, which is not the case in wars because aid can be seen to be benefiting the enemy rather than the common good. Humanitarianism can be traced from the major world religions through Cicero, medieval philosopher St. Thomas Aquinas, father of international law Hugo Grotius, and liberal peace philosopher Immanuel Kant. As a codified modern international institutionalized response, humanitarianism can be traced back to the Battle of Solferino (1859), when Henri Dunant's actions led to the formation of the International Committee of the Red Cross, to his lobbying for Napoleon III to proclaim the rights of the wounded, and to the 1864 Geneva Convention. Norm evolution since then has both sought to constrain state actions and enable international succor for natural and many human-made disasters (Weiss and Collins 2000). In the case of the tsunami, we have seen that "competitive compassion" resulted in what many even saw as excess resources for the tsunami victims.

In a human security frame, the network is more likely to be self-organized, meaning the number of actors, as well as the type of actor involved could be increased, allowing for an openness and transparency that could be met by communication among the actors. In contrast, the organization of the actors in the networks that prevent nuclear proliferation is for the most part, not self-organized, which has implications for its effectiveness. This in turn allows accountability: progress, or lack thereof, could be openly tracked through the media as in the case of the Indian Ocean tsunami (Telford and Cosgrave 2006), or through nongovernmental organizations such as the World Nuclear Association. A network that is more formally organized, by treaties and executive agreements, may be more stable and permanent, but it is likely to be less open, and more rigid in responding to new attempts at proliferation.

States in the nonproliferation network, by attempting to hold onto their *de jure* authority, may be denying the network as a whole the flexibility and transparency it needs to counter proliferation: "The relationships between the DPRK [North Korean] and Khan networks show the shifting roles that ring members may play, with the DPRK acting on different occasions as a buyer, seller, and supplier to mutual partners" (Braun and Chyba 2004). Stopping or at least controlling proliferation is important; as Sagan explained, more nuclear states will be worse for the world. Novice nuclear states lack either adequate military or civilian political organizational controls, and therefore have a higher risk of either deliberate or accidental nuclear war. Deterrence strategy took the U.S. and U.S.S.R. years to work out; many new nuclear states seem completely unaware of the depth of thinking necessary. Furthermore, deterrence may not work, because

novice nuclear states' capability may not survive to make a second-strike (Sagan and Waltz 1995).

### Network Measurements

All calculations were performed with Ucinet 6 and all images were created using Netdraw (Borgatti, et al. 2002), unless otherwise noted. The compulsory power network for the tsunami consisted of 2,107 records of financial transactions among 505 distinct actors from the Financial Tracking Service database. These actors were states, IGOs, NGOs, companies, academic institutions, municipalities, news media organizations, and private individuals, with a reserve category of “unspecified” for those that could not be traced via web search (Kamran 2009a). This network will be referred to as the “transnational aid flows” network. The institutional power network for the tsunami consisted of 2,504 records of cooperative interactions among 234 distinct actors culled from OCHA’s situation reports, in the following categories: state, IGO, NGO, academic institution, company, state-owned company, multiple (indicating an organization with multiple types of actors acting as one), and private individual (Kamran 2009a). This network will be referred to as the “OCHA sitreps” network.

The compulsory power network for nuclear nonproliferation consisted of 575 records of financial transactions among 454 distinct actors created from the Business Source Premier (now called Business Source Complete) database maintained by EBSCO. These actors were states, companies, state-owned corporations, joint action agencies (joint-action agencies are owned by their members, which are electricity cooperatives), partnerships, joint ventures, academic institutions, nongovernmental organizations (NGOs), intergovernmental organizations (IGOs), and unknown. Actors were coded as state-owned if they were more than 50% owned by a state (Kamran 2009b). This network will be referred to as the “nuclear contracts” network. The institutional power network for nuclear nonproliferation consisted of 196 distinct actors related by twelve treaties or agreements. These actors were all states as recognized by the United Nations, with the exception of Taiwan, Republic of China (Kamran 2009b). This network will be referred to as the “nuclear treaties” network. For more information on all these networks, please refer to the sources.

The most commonly used measures to examine social networks are density, centrality, cohesion, and durability. Density in a network is a measure indicating the total of all existing ties divided by the number of ties possible in the network (with the value of the ties being included in ordinal networks). Within and between block densities can be calculated for data that are grouped. For example, data can be partitioned into different types of organizations and examined for the density of information exchange within and between types—a key measure of diffusion of ideas.

#### Box 1: Density

Frame	Relation	Network	Density
Human Security	Compulsory power	transnational aid flows	0.9
	Institutional power	OCHA sitreps	1.0
Traditional Security	Compulsory power	nuclear contracts	1.1

	Institutional power	nuclear treaties	2.4
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As is clear from Box 1, density is higher in traditional security networks than in human security networks. This is likely a reflection of flexibility and ease of making/breaking ties in human security networks. However, it also indicates that the speed at which information diffuses among the actors is relatively quicker in the traditional security networks, and the extent to which actors in those networks have levels of social constraint is higher than in human security networks. Density is also higher in the compulsory power relations than in the institutional power relations of both human and traditional security networks, demonstrating that making ties in order to share information and expertise (as well as enforcement) generally involves more than bilateral ties—information diffusion is maximized when there are more actors in the network.

Centrality is a key indication of power, because it measures how information and resources flow or fail to. “Closeness centrality” indicates the shortest paths to all other actors, while “degree centrality” the number of direct connections an actor has. The best way to understand these measurements are in-degrees and out-degrees, indicating actors by the number of choices that they could make and the number of ties established by them.

Box 2: Centrality

Frame	Relation	Network	Closeness Centrality	Degree Centrality
Human Security	Compulsory power	transnational aid flows	(this measure is not applicable in a disconnected graph)	<ul style="list-style-type: none"> <li>Private (individual donations)</li> <li>United States</li> <li>United Kingdom</li> <li>EC Humanitarian Aid Office</li> </ul>
				<ul style="list-style-type: none"> <li>IFRC</li> <li>International Organization for Migration</li> <li>UN OCHA</li> <li>World Health Organization</li> </ul>
	Institutional power	OCHA sitreps	<ul style="list-style-type: none"> <li>UN</li> <li>Indonesia</li> <li>Sri Lanka</li> <li>Thailand</li> <li>US</li> </ul>	<ul style="list-style-type: none"> <li>UN</li> <li>Indonesia</li> <li>Sri Lanka</li> <li>Thailand</li> <li>US</li> </ul>
Traditional Security	Compulsory power	nuclear contracts	<ul style="list-style-type: none"> <li>Areva</li> <li>Framatome ANP</li> <li>Exelon Corp</li> <li>Westinghouse Electric Co</li> <li>US Department of Energy</li> </ul>	<ul style="list-style-type: none"> <li>Westinghouse Electric Co</li> <li>Chernobyl Shelter Project</li> <li>US Department of Energy</li> <li>Framatome ANP</li> <li>Areva</li> </ul>

	Institutional power	nuclear treaties	<ul style="list-style-type: none"> <li>• Australia</li> <li>• New Zealand</li> <li>• Argentina</li> <li>• Austria</li> <li>• Belgium</li> </ul>	<ul style="list-style-type: none"> <li>• Australia</li> <li>• New Zealand</li> <li>• Argentina</li> <li>• Austria</li> <li>• Belgium</li> </ul>
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Box 2 shows the actors in each network with the highest centrality scores. Degree centrality for “transnational aid flows” is divided into outdegree (on top) for aid donors and indegree (on bottom) for aid recipients. There can be important differences in which actors are most central according to the measure used, which is why it is recommended to look at more than one measure. One thing that becomes clear, however, is that nonstate actors can be as or more important to the structure and functioning of the network than state actors.

Cohesion measures sub-structures within networks, such as alliances or even cliques. Cohesive subgroups have four general properties: mutuality of ties, closeness or “reachability” of subgroup members, frequency of ties among members, and the relative frequency of ties among subgroup members compared to non-members (Wasserman and Faust 1994). The institutional power relation networks were more cohesive than the compulsory power networks, even though in the human security frame the organizations did not necessarily have ties prior to the event while in the traditional security frame the cohesion was the result of long and painstaking multilateral treaty negotiation-. This result has implications for effectiveness at responding to a security event: networks that are not cohesive are less likely to communicate well, and should therefore be more likely to duplicate efforts and waste resources.

There are many measures that look at the similarity of roles in a network. Structural equivalence indicates that different actors share a jointly occupied position in the network. For example, if actor A and actor B both have ties to actor C, they share a position. The pattern of ties to other actors is emphasized here; it is the similarity of ties that creates the shared position, not that the actors share the same ties (White *et al.* 1976). Actor A could have a tie to an actor that is similar to actor C, and that would still be regarded as structurally equivalent. In the transnational aid flows network, there was an interesting breakdown of actors into large clusters of aggregators and channels. Aggregators collected aid from individuals and from other organizations and passed it on to channels, which delivered the aid, either themselves or through others in the region. In the OCHA sitreps network, the cutpoints, or the actors that were major hubs for information, were the UN, the World Health Organization (WHO), Maldives, Thailand, Sri Lanka, and Indonesia. The equivalence classes in the nuclear treaty network points out the danger that many nuclear weapons states are in separate class. Also, there are states in these classes that have indigenous nuclear capabilities, either for research, power generation, or both. Another way to discover structural equivalence is through hierarchical clustering. For the nuclear contracts network, these hierarchical clusters show that being different organization types does not hamper certain types of similarity. For example, Areva is a vertically-integrated organization with contracts from suppliers and to customers at every stage of the fuel cycle from mining to plant operation. The

other actors in Areva's "class" have similar patterns of ties, whether they are state-owned corporations like Areva or not.

A drawback to social network analysis is that it relies ultimately on quantification and is a crude measure for dealing with unquantifiable nuance or the rich contextual detail of more qualitative studies. However, SNA is suitable for getting "the big picture," or persistent patterns of behavior within the contemporary world order. Furthermore, using the language and methods of social network analysis allows researchers to enter into a genuine dialogue with other disciplines that deal with networks of interactions such as mathematics, physics, and biology. For example, it may be possible to re-create missing data about relationships in a network through Bayesian analysis. Recent research in biology used Bayesian network analysis to predict the number and location of links in a cellular network, which was then tested against what is known about that network from independent research. The study found that their network analysis was highly successful in predicting links from limited amounts of information (Sachs et al. 2005).

### **Intersectionality**

The concept of intersectionality first surfaced in critical theory, and was best explained by Kimberle Crenshaw in a study on the effects of different types of violence on women of color. She found that the narratives that describe, explain, and circumscribe race and gender are coded—"blacks" are male in the mainstream narratives, while "females" are white. Intersectionality refers to the properties exhibited by actors that belong to racial and gender identity groups that are narratively treated as being mutually exclusive. This could have disastrous effects on policy choices, preventing women of color from reporting violence, from preventing violence, and from accessing services for domestic violence victims. "Although racism and sexism readily intersect in the lives of real people, they seldom do in feminist and antiracist practices. And so, when the practices expound identity as woman or person of color as an either/or proposition, they relegate the identity of women of color to a location that resists telling" (Crenshaw 1991). In other words, actors belonging to multiple networks (as measured by their different relationships) can be expected to have different identities, to face different structural opportunities and constraints, and to pursue different interests.

Feminists have recognized a "need for understanding complexities posed by intersections of different axis of differentiation." Intersectionality thus signifies "the complex, irreducible, varied, and variable effects which ensue when multiple axis of differentiation – economic, political, cultural, psychic, subjective and experiential – intersect in historically specific contexts. The concept emphasizes that different dimensions of social life cannot be separated out into discrete and pure strands"(Brah and Phoenix 2004). Actors at intersections do not experience identity as additive—black + female = black female—they experience identity in unique ways, often in opposition to the mainstream narrative.

Intersectionality is therefore a complex and fluid concept, difficult to operationalize, and even more difficult to quantify—unless we marry network analysis to

mathematics: membership in a network is a dimension of identity (whether for individual or collective actors), and again, the networks themselves can be considered cells or subsets of a set or hypergraph. Thus, the intersection of two sets  $A$  and  $B$  is the set that contains all elements of  $A$  that also belong to  $B$  (or equivalently, all elements of  $B$  that also belong to  $A$ ), but no other elements.

To find the intersection of the four networks discussed here, the software program ORA (Carley 2010) yielded some interesting results: Australia, Austria, Belgium, Canada, India, Denmark, Finland, France, Germany, Italy, Japan, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States were the members of this class appearing in all four networks. All are states; there are no nonstate actors in the group. While realists might point out that this would be their expected result anyway, it is an important result because the intersection does not depend on *a priori* definitions of actors but on the relations in which these actors are active. As a result, it could change in the future—indeed, one could argue that within the United Nations family there are treaty-based non-proliferation organizations, so the United Nations should also be included in the intersection and that it was not is a mere artefact of coding.

Furthermore, the focus on multiple relations or layers means that the actors in the intersection are not just features in the network surface topography, but are prominent in the networks' geology. It comes as no surprise that the highly developed states of Western Europe, North America, Australia, and Japan are active in the provision of security in many frames and relations. However, the intersection also indicates that there are newcomers to this club such as India. There are also notable no-shows, such as China, Brazil, and Russia.

There are several possible uses for intersections. This would be useful for “profiling,” or to ask a specific question of multiple networks (i.e., how many actors fit a specific profile). It could be used to find a core of actors in multiple networks. This would be useful in global economic governance in taking the economy's “temperature” in testing the network positions of companies in different industries, if one has reliable transaction data (Germain 2007, Setser 2008, Bernanke 2008). For example, the definition of “too big to fail” might be those actors with high centrality measures at the intersection of multiple networks as measured by relation type. A banking relationship such as Countrywide Financial Corp. and American International Group Inc. that is at the center of both mortgage lending and offering securitized debt as an investment is a case in point (This American Life 2008, Center for Public Integrity 2009). And it could be used to test for change over time by looking at the same network at multiple points in time (i.e., asking is there a stable group of core actors). It should be emphasized that the use of intersections should be as a test for further study—it is a quick method to see if further study is warranted.

### **Network Strategies Depend on the Framework**



Network analysis is a tool for assessing systemic risk, and regulating accordingly. Instead of focusing on the type of actor when developing legislation or other types of regulation, regulators should focus on the relationships among them—that is, they should use network analysis in crafting their rules and regulations. For example, all the actors in finance are connected by each trade or other financial transaction they make; among banks, mortgage companies, credit unions, and so on, every transaction is a relationship. All of these relationships together make a network. If we look at a specific type of transaction using social network analysis, we should see how financial actors are wired together.

The problem of security and stability in global financial networks is not simply one of sheer size, but that some of these actors will be more central than others. There are many measures of centrality—some actors will have more interactions, or will have ties to more partners, or will closely connect such actors without being as active in trading themselves (Wasserman and Faust 1994). For example, “degree centrality” simply measures the number of ties an actor has. If the relationship is directed, as in the flow of money from one actor to another, we can also speak of in-degrees and out-degrees, and in the case of money, the relationship is also valued. Even just using this one measure, we can examine the network to see which actors are dealing with each other, how much that trade is worth, and in which direction the exchange is flowing.

Network density and flexibility is critically important when context is a deciding factor: culture and geography. High measures of density and low flexibility in terms of joining/leaving the network are desirable when enforcement is self-administered and where the threat is of long standing, as in the case of nuclear nonproliferation. In this case, allowing states to exit the system of nonproliferation treaties should be discouraged as much as possible. Similarly, nuclear states should be incorporated into the system. Slow-moving threats such as this require more consensus and therefore more institutionalization, so the aim should be to make the network as dense as possible.

Density is less important while flexibility is more so when the actors must cooperate quickly but not permanently in vastly different regions with different needs, as in the case of the tsunami. If you need to respond to a fast-moving threat, you need both a “backbone” of trusted actors that know how to work well together (even if they do not work together all the time or even regularly), and the ability to scale up quickly by accepting or creating ties to other actors.

Actors in global politics may also occupy different roles within networks such as cutpoint and broker, actors that connect otherwise unrelated clusters of individuals. Removal of these nodes splits the network into two separate networks that do not interact with each other. The number and the value of these relationships may not look especially significant to the network, but these nodes play important parts in passing on the effects of shocks such as contagion and bankruptcy.

## **Toward a Future Research Agenda**

We obviously are at an early stage, and capturing global governance data will be problematic until social scientists become more aware of the abundance of data inherent in the increasingly digitized records of movements and transactions by actors of every stripe. The possibilities of finding or recording digitized data, and using it to examine interaction patterns will grow. Meaningful global governance data is available if we have better theory to guide us. For instance, it would be useful to imagine a laser's sending a sheet of light through a cloud of smoke as it swirls in a current. Many slices will be required just to approach a three-dimensional model of the cloud, and we require the fourth dimension of time to show air currents. We cannot merely examine one network at one point in time—not only do we need lots of slices, but we need to see them in proper sequence. We require better pictures, or thick descriptions, of both constituent actors and processes.

Global governance has been a difficult concept to grasp because its manifestations sometimes seem inconsistent. Imploding states and the European Union are part of contemporary reality, which reflect James Rosenau's "fragmegration" (Rosenau 1997). Keeping in mind simultaneously what seem like inconsistencies is a perceptual problem and not an indicator that global governance cannot be understood or made to work better. Without adequate depictions of what is going on, policy prescriptions are elusive—hence, simultaneous calls for more robust multilateralism as well as for stronger states. If we look at sovereignty as an anomaly—or a cancer metastasizing in various directions and preventing common solutions—we need tools for diagnosis and prognosis before we can apply the correct drugs or surgery. In any case, far more robust and diverse international institutions are bound to be part of the mix.

It is ironic that cooperation in extreme security situations such as the tsunami and nuclear nonproliferation appears to be much more effective than it is in situations far more likely to occur, more likely to affect more people, and more likely to threaten the state, such as the cooperation required to assure global financial stability. Further research should investigate the possibility that governing global common pool resources such as security is easier at the extremes.

At this time, it is impossible to use global governance theory to predict global system change or system-wide conflict, but that does not distinguish it from other bodies of theory. To continue the medical analogy, it would be like trying to predict multiple organ failure. I suspect that as global governance theory develops and our understanding improves, we may be able to use this framework to foresee just these kinds of changes within the world system. Slices would show us structural positions, and slices over time could show patterns of change. For example, the structure could show which states are becoming weaker relative to other actors. Their situations could then be investigated more closely to uncover the possible reasons, which could be compared to actors with similar structural patterns elsewhere in the system. As one group of analysts writes, "Finding local fluidity and global stability...suggests that change moves through structurally equivalent actors" (Moody *et al.* 2005).

Better information could also be used to calculate probabilities; for instance that a structure exhibiting certain characteristics is likely to change in predictable ways. Network statistical applications could be particularly useful, especially in modeling the cooperation between individual actors in the framework of dynamic or evolutionary game theory. Absolute predictability is impossible because all subsequent conditions are explained partially by previous ones and partially by chance. In spite of this randomness, global governance is about numerous actors' self-organizing through formal and informal means to meet worldwide challenges.

## **Conclusion**

Many observers attribute a normative aspect to global governance: i.e., it should be this, it should achieve that. I would argue that it is early days yet, and we don't know enough about what is happening to make judgments about the directions in which we want to move. For example, should global institutions be more democratic or more efficient? And how should they be designed—around the relationship or around the type of actor? The purpose of using SNA to model global governance is to create a road map so we can decide where we want to go.

The study of structure, or the paths and processes of interactions, is essential to the study of agency, which is why as IR analysts we should move from being slicers of cheese to MRI technicians. University of Chicago historian and philosopher of theory development William Sewell theorized that dynamic structures are produced, reproduced, and transformed by human agency (Sewell 1992). His approach works equally well in history, sociology, and political science. In this vein, I seek to describe, explain, and predict politics at the global level in ways that are comprehensible to others. Our task then is to create a qualitative model of global governance that can identify the most important processes by which human beings can exercise their agency, regaining control over themselves and the globe's destiny.

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