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What is This?

Complexity Theory, Systems Theory, and Multiple Intersecting Social Inequalities

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This article contributes to the revision of the concept of system in social theory using complexity theory. The old concept of social system is widely discredited; a new concept of social system can more adequately constitute an explanatory framework. Complexity theory offers the toolkit needed for this paradigm shift in social theory. The route taken is not via Luhmann, but rather the insights of complexity theorists in the sciences are applied to the tradition of social theory inspired by Marx, Weber, and Simmel. The article contributes to the theorization of intersectionality in social theory as well as to the philosophy of social science. It addresses the challenge of theorizing the intersection of multiple complex social inequalities, exploring the various alternative approaches, before rethinking the concept of social system. It investigates and applies, for the first time, the implications of complexity theory for the analysis of multiple intersecting social inequalities.

Keywords: *complexity theory; inequality; intersectionality; social theory*

This article contributes to the revision of the concept of system in social theory using complexity theory. While sociology has had something of a hiatus in the development of concepts of system since the rejection of simple forms of Marxism and functionalism (though with some exceptions such as the work of Luhmann), other disciplines, influenced by complexity theory, have engaged in its revision so as to overcome the oft-mentioned problems of early formulations of the notion of system. Complexity theory is a loose collection of work that addresses fundamental questions on the nature of systems and their changes. Rather than the conventional focus on developing the concept of system by engaging with the work of Luhmann, this article offers an alternative route to the development of the concept of system

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through a synthesis of complexity theory with social theory more inspired by the heritage of Marx, Weber, and Simmel rather than that of Durkheim and Parsons. While there is a rapidly developing set of discussions on the implications of complexity theory for social theory, there has been as yet no application of this to the issue of multiple intersecting social inequalities.

The practical focus of the article is the theorization of simultaneous multiple social inequalities, which has become a major issue in social theory. Not only is the intersection of gender with class important, but also those with ethnicities, nation, religion and other complex inequalities. While there is a wealth of empirical material on these intersections in sociology and other social sciences, their theorization remains difficult and contested. Their theorization as intersecting systems is challenged by the critique of the old systems theory, but the major alternative theorization within postmodern paradigm has a tendency to fragmentation and to micro or cultural reductionism especially in the use of the concept of identity. It is argued here that a revised concept of social system is necessary to adequately achieve the theorization of the intersection of multiple complex inequalities. Complexity theory offers a route toward the resolution of these theoretical dilemmas.

It is time for a paradigm change in sociological theory, in the sense intended by Kuhn and Lakatos. The old concept of social system is widely discredited. The attempt to build social theory without (at least implicitly) using the concept of a social system has failed. Complexity theory offers the toolkit with which a new paradigm in social theory is being built. A new concept of social system is possible that, linked with a range of linked concepts, more adequately constitutes an explanatory framework.

The article is intended to be a contribution to the theorization of intersectionality in social theory as well as to the philosophy of social science. It addresses the challenge as to how to theorize the intersection of multiple complex social inequalities, exploring the various alternative approaches, before turning to the rethinking of the concept of social system, drawing on complexity theory. It investigates and applies, for the first time, the implications of complexity theory for the analysis of multiple intersecting social inequalities.

Intersectionality

Intersectionality is a relatively new term to describe an old question in theorization of the relationship between different forms of social inequality. One of the complications of theorizing simultaneously multiple complex

inequalities is that at the point of intersection it is insufficient to treat them merely as if they are to be added up, because they can also change each other. Adding up the disadvantages, as in the notion of double or triple disadvantage, does not fully account for the intersection; they may often, at least partially, mutually constitute each other (Brah and Phoenix 2004; Collins 1998; Crenshaw 1991; McCall 2005; Phoenix and Pattynama 2006). This is not a new issue in social theory (Jakobsen 1998), since it lay at the heart of the debates on the intersection of gender and class (Crompton and Mann 1986) especially in dual systems theory (Hartmann 1976; Mies 1986; Walby 1986), as well as other analyses of gender, ethnicity, and class (Westwood 1984; Phizacklea 1990), but it has been given a new inflection under the auspices of the concept of intersectionality, especially as launched by Crenshaw (1991) in relation to the intersection of gender and ethnicity.

The challenge is to include these inequalities in the center rather than the margins of social theory. There are at least five approaches to the analysis of intersectionality, broadly defined, in social science, which can be divided into two types: those that utilize, whether explicitly or implicitly, a concept of system; and those that reject concepts of social system as inherently incapable of addressing this task.

The starting point in the debates is a criticism of false over-generalizations. For example there are divisions within the category of woman by class, by ethnicity, and by whether they are from the North or South of the world (Mohanty 1991). Few would disagree with this point. However, this is sometimes linked to a more general turn in social theory toward the particular and a critique of the so-called meta-narratives (Lyotard 1978; Mirza 1997), which is more open to contestation.

The second approach to multiple inequalities is that of reductionism to a single primary axis of social inequality. One form of reductionism, found especially but not only in Marxist inspired social theory, is to class or capitalism (Jessop 2002). A range of social inequalities may be empirically noted, but explained as an outcome of one overarching system of inequality. In response to this form of reductionism, there were many attempts to constitute gender and class as articulating systems (Hartmann 1976; Walby 1986) or as partial systems that were partially rather than fully subordinated to a single system (e.g. Gottfried's [2000] work on embedded gender contracts). These developments suffered criticisms that were as much oriented toward the problems of the concept of system as to any other aspect of the work.

A third approach is that of micro-reductionism. This position grew from a rejection of the conceptualization of social relations in terms of systems. Systems analysis was rejected as intrinsically incapable of theorizing the

many forms of difference and inequality (Barrett and Phillips 1992). In pursuit of the analysis of intersectionality, there is an analytic strategy of identifying and studying neglected intersections (Crenshaw 1991). This is intended to analyse groups at the point of intersection, e.g. female, African-American, working class. It is often associated with the use of case study, ethnographic and narrative methods of enquiry (e.g. Prins 2006). McCall (2005) in her review of intersectionality refers to this as "intracategorical intersectionality." However, there are a number of problems. This has tended to become a strategy of seeking out ever finer units for analysis, in pursuit of a pure intersecting category. But, there are no pure groups; there are always more forms of difference; there will still always be some differences within the group being researched (Jakobsen 1998; McCall 2005). There is also a tendency to cultural reductionism; and the use of rather static identity categories, even though it was a critique of the restrictive use of the concept of "identity" that was the starting point for Crenshaw's analysis. Furthermore, with such a micro approach it is hard to address larger questions, such as those involving a global horizon (Benhabib 1999)

Fourth, is the rejection of categories altogether (anticategorical complexity in McCall's [2005] analysis). The limitations of the strategy of identifying groups at specific intersections and in particular identity analysis led to challenges to the strategy of developing categories at all. Analytic categories were seen as not only never adequate representations of the lived world, but as indeed potentially pernicious in their potential for false sedimentation of these categories in practice. Hence a focus on difference was preferred to that on identify. The destabilization of group categories became the aim of some forms of analysis, from Butler's (1990) preference for the notion of performance over agency to Braidotti's (1994) use of the metaphor of "nomad" to privilege the crossing of borders. However, such radical deconstruction and destabilization of categories makes substantive analysis, which requires distinctions between categories, rather hard (Felski 1997; Sayer 1997).

Fifth, is a strategy that may be described as segregationary reductionist, in which each strand is identified with and reduced to a single and separate base. Rather than rejecting categories, instead the analytic strategy is to build up a better analysis of each of the sets of social inequalities as part of the process of analysing their intersection. Each set of social relations as identical or parallel, is considered to have a different ontological base (Verloo 2006; Yuval-Davis 2006). As Yuval-Davis puts this:

> The ontological basis of each of these divisions is autonomous, and each prioritizes different spheres of social relations . . . For example, class divisions

are grounded in relation to the economic processes of production and consumption; gender should be understood not as a "real" social difference between men and women, but as a mode of discourse that relates to groups of subjects whose social roles are defined by their sexual/biological difference . . . Ethnic and racial divisions relate to discourses of collectivities constructed around exclusionary/inclusionary boundaries. (Yuval Davis 2006, 200-1)

This approach segregates the bases of each of the categories: class is grounded in the economy; gender is a discourse about sexual and biological differences; ethnicity relates to discourses about exclusion and inclusion. The implication appears to be a relatively simple base-superstructure understanding of each set of social relations.

Another example of this approach is that of Esping-Andersen (1990, 1999), who tries to include gender as well as class in his analysis of the development of three forms of welfare state regime (liberal, social democratic, conservative corporatist). Although empirically he notes the importance of women, he nevertheless declares gender to be not core to his theoretical models, making no difference to his distinctions between categories of welfare regime. Gender is reduced to and theoretically confined to the family. Gender is constituted in the family; it is not constituted in employment or state, rather, in these latter domains, gender is an outcome not an input.

The reason for this is that he can theorize only one set of social relations in each institutional domain: class in the economy and state; gender in the family. This is a segregationary reductionist approach. Such segregation of the institutional bases of each set of unequal social relation means that there is in fact very little potential for the theorization of intersectionality; in particular, of the mutual constitution of the categories. Since each category has a separate ontological base, how can they, in theory, mutually constitute each other?

These different approaches to intersectionality tend to fall into two kinds when the concept of system is brought into focus: those that try to use and develop the concept, often within a modernist approach; and those that reject it and take the post modern turn toward discourse, deconstruction and identity.

Full Ontological Depth of Each
Set of Social Relations

So what is the solution to these theoretical dilemmas? While the fifth approach, which attempts to separately identify the ontology of each set of

social relations, is a step in the right direction, it needs to be taken much further in at least two ways. First, it is necessary to theorize more fully the ontological depth of each set of social relations. Rather than there being merely a single base to each of these sets of social relations, there is a much deeper ontology, including the full range of domains: economy, polity, violence nexus, and civil society. Within each domain (economy, polity, violence, civil society), there are multiple sets of social relations (e.g. gender, class, ethnicity) (Walby 1990, 2004, 2008). Each institutionalized domain and each set of social relations are here conceptualized as systems, not parts of systems. This avoids the rigidity of the notion of a system as made up of its parts. Systems can be over-lapping and non-nested. These domains are not the only social systems (there are others at different levels of abstraction); but they are the ones that are the center of the analysis here. Second, it is necessary to theorize more fully the relationship between systems of social relations and how they affect each other together with the dynamics of social change.

The Challenge to Systems Theory

Why is this approach not generally seen as an available theoretical solution? This new approach requires the theorization of multiple sets of social relations in the same institutional domain, but pre-complexity systems theory makes this unavailable as a theoretical option. It requires a concept of system that does not insist that it necessarily saturates its territory; but pre-complexity systems theory does not allow that. It requires a concept of system that allows for more than one set of social relations in the economy (and other levels) without insisting on a nested hierarchy, in which all non-class relations were theoretically subordinated to class; but old systems theory does not allow that either. It requires a concept of system that does not insist that gender has a institutionally different base (e.g. culture, family) from that of class (rooted in the economic), but allows both class and gender to have onto-logical depth, each constituted in all these domains; but the old systems theory does not allow for that. The attempt to theorize simultaneously multiple inequalities without a necessarily hierarchical and nested relationship between them puts pressure on the old conceptualization of system. It is stretched to breaking point.

Complexity theory challenges further aspects of systems theory, especially those forms associated with Durkheim (1966) and Parsons (1951). The notion that equilibrium was the norm to which a system would return if there were a small deviation, via the mechanism of a negative feedback loop, is challenged

by the discovery of positive feedback loops that drive a system forward beyond equilibrium (Arthur 1994; David 1985). Small changes when a system is far from equilibrium can have substantial effects, precipitating sudden turns into new paths of development at these critical turning points. This challenges the previously conventional assumption in systems theory of proportionality between cause and effect, introducing the notion of non-linearity in the relations between entities during such processes of change (Capra 1997; Kauffman 1993; Waldrop 1992). The implications of these developments in systems theory associated with complexity theory for the analysis of intersectionality have not been previously explored.

Rejection of the Concept of System in Sociology

A common response to these theoretical pressures on the old concept of system was to abandon the concept of system altogether as part of the post-modern turn, which looked to discourse, deconstruction and identity as ways out of this perceived theoretical impasse (Barrett and Phillips 1992; Braidotti 1994; Lyotard 1978). This turn was often associated with a prioriti-zation of agency and a rejection as to what was seen as the tendency to ignore human action in many forms of structural or system-led explanations. For example, attempts to meld the analysis of gender with Marxism were some-times alleged to become "abstract structuralism" (Pollert 1996).

Yet, even though the concept of system has often been overtly rejected in sociology, some nearly equivalent notion is often deployed though under a different name. There are many concepts in social theory that are similar to and parallel to that of system that address the issue of social interconnect-edness and address a social level that is not reducible to that of individuals. They include the concepts of "social relations" (Emirbayer 1997; Somers 1998), "regime" (Connell 1987; Esping-Andersen 1990, 1999), "network" (Latour 1987; Scott 2000), and "discourse" (Foucault 1997). Some concept is often found to be needed to address the conceptualization of social inter-connections. However, the negative connotations attached to the concept of system have been sufficiently great that many prefer to indicate this using a term other than system.

Complexity Theory and its Varieties

While few in sociology have tried to develop the concept of system in recent years (though with exceptions, most notably that of Luhmann [1995]),

in other disciplines the discovery of difficulties in the concept of system led to its revision rather than rejection. The rejection of the concept of system in much, though not all, sociology, is a limited response to the difficulties discovered. Instead it is possible, indeed necessary, to revise the concept of system. Complexity theory provides the conceptual toolbox with which this can be accomplished.

Complexity theory is not a unified body of theory (Thrift 1999); it is an emerging approach or framework. It is a set of theoretical and conceptual tools; not a single theory to be adopted holistically. Complexity notions have developed across a range of disciplines, both natural and social sciences, from ecology to mathematics (Capra 1997; Maturana and Varela 1980; Waldrop 1992). There are two kinds of differences: differences within complexity theory itself; as well as differences in the interpretation of the implications of complexity theory within social theory.

Complexity theory contains several different approaches, substantive foci, and theoretical priorities. Among these is a division between the Prigogine (1997) inflected chaos theory and the more systems based Santa Fé approach (Waldrop 1992), although this distinction should not be exaggerated. The Prigogine (1997; Prigogine and Stengers 1984) influenced school tends to focus on chaos theory, though this is the discovery of order within ostensible chaos, embracing and emphasizing the element of the unknowable. There is a challenge to the easy assumption of direct proportionality between changes in the size of the phenomena under investigation (Abbot 2001), since a small event may tip the balance in a system that is far from equilibrium, leading to sudden new paths of development. This means that, in mathematical terms, there is a non-linear rather than linear relationship between them, demanding much more complicated analysis. The Santa Fé research center by contrast has placed high priority on finding order where others thought there was none. They searched for and found patterning in phenomena others saw as merely chaotic, indeed as random. A highly sophisticated mathematics harnessed to new computing power is the basis of their continuing commitment to a merely reformed scientific methodology to deliver improved knowledge of patterns in the universe. However, while the differences between the various interpretations of complexity theory may be significant (Medd 2001), the apparent divergence between the Santa Fé and Prigogine schools of complexity and chaos theory should not be overstated. If the former is seen as more concerned with mathematically modelling the inner structuration of systems, while the latter focuses on their external relations then their efforts may be considered more complementary than opposed (Harvey 2001).

The interpretation of complexity theory by social scientists is also very varied. Byrne (1998) argues that complexity theory constitutes a defence of realism, while Cilliers' (1998) considers that complexity theory advances postmodernism. There are several different approaches to the utilization of complexity concepts in Sociology, including Luhmann's (1995) synthesis with Parsonian functionalism phenomenology, Jessop's (2002) synthesis of Luhmann with Poulantzas inflected Marxism, Urry (2005) on mobilities and the global, and De Landa's (2000) focus on nonlinearity. Wynne (2005) positions complexity theory as a challenge to both reductionism and the denial of uncertainty among science policy makers. McLennan (2006) has been critical of the use of complexity theory, but he focuses on highly selected sections of versions of the chaos, Prigogine inflected variants with much less attention to other versions such as those inspired by the Santa Fé school.

Perhaps the most developed and widely cited example of the use of complexity notions in social theory, especially in relation to the concept of system, is that of Luhmann (1985, 1990, 1995, 2000). Luhmann synthesizes functionalism and phenomenology with the early insights of complexity theory (Knodt 1995) and thereby challenges the simpler versions of the critique of functionalism. However, the range of complexity notions that Luhmann introduces is quite small. Furthermore, the absence of any inflection from a Marxian tradition of sociology is associated with the absence of concern for issues of power, inequality, economics, and politics. This means that his work does not make a decisive break from some of the problematic features of previous systems theory. For example, there is no explicit rejection of the assumption of consensus as the norm, since he is not interested in discussing power and inequality. In addition the level of abstraction at which his work is pitched meant that there was neither much sense of practical application nor was it a satisfying way to address the issue of agency. As such, Luhmann is perhaps at best an uninspiring ambassador of complexity theory for much contemporary sociology; at worst, a distraction that slowed the utilization of the toolkit of complexity thinking within social theory and discouraged wider engagement in the rethinking of the concept of social system.

More promising is the range of attempts to take a Marxist (or Weberian) inspired sociological heritage and either synthesise or inflect with complexity theory (Byrne 1998; Jessop 2002; Cudworth 2005; Urry 2005). In many ways the Marxian heritage is more open to complexity notions because of its interest in theorizing the sudden ruptures of political upheavals, and interest in dynamic systems far from equilibrium (Reed and Harvey 1992; Urry 2003). Although these writers share an interest in social inequality and injustice, they do not however address the issue of the intersection of multiple social inequalities.

My utilization of complexity theory is not a simple adoption of concepts from other disciplines, but an active process of selecting insights that can be synthesized with social theory, rather than imported or transplanted in their entirety. I offer my own hybridization of complexity theory with social theory here to address the challenge of intersectionality. It is positioned within the tradition of social theory inspired by Marx and Weber rather than that of Durkheim and Parsons, the forerunners of Luhmann.

Revising Social Theory Using Complexity Theory

While there are many aspects of complexity theory that are useful to sociology, here I focus on a limited number of concepts that are especially relevant to the development of the concept of system for the analysis of intersectionality. Hence the focus is on the system/environment distinction; the non-saturation by a system of the territory that a system inhabits; and the potentially non-nested nature of systems. In addition, there are issues of emergence, path dependency, and the coevolution of complex adaptive systems (for further development see Walby 2008).

The distinction between system and environment is disarmingly simple, but it is key to a series of revisions that enable greater flexibility in the conceptualization of systems. It enables the notion that each system takes all other systems as its environment (Bertalanffy 1968). This makes it possible to go beyond the old notion that the parts of a system make up the whole. Instead, each social system (whether economy, polity, violence nexus, or civil society) takes all other systems as its environment. Likewise each set of social relations (e.g. gender, ethnicity, class) is a system, taking all others as its environment.

This distinction between a system and its environment does not entail a presumption of hierarchy between inter-connected phenomena; rather hierarchy is a special case of differentiated systems. This makes for a more flexible conceptualization, providing the conceptual possibility to avoid rigidities such as that of "part and whole" (Parsons 1951) and of 'base-superstructure' (Marx 1967), as well as the ambiguities of 'relative autonomy' (Althusser 1971). These involve some kind of hierarchical relationship between nested sub-parts of a system. The sub-systems in Parsons' (1951) formulation are a particularly rigid example of this. Within Marxist systems theory there were two interpretations of the formulation. The simpler and more popular version was that of a base-superstructure model, in which the economic base determined the political and cultural superstructure. A more

complex interpretation was that of Althusser's relative autonomy, that removed the simple hierarchy of these elements, making it a relative hierarchy. This in turn raised the question of the degree of autonomy entailed without unduly stretching the notion of the relative hierarchy of the elements.

The notion that each system has as its environment all other systems is used to replace the rigid notion of a hierarchy of sub-systems by a much more fluid conception of the mutual impact of systems. This means that the phenomena that many systems-based Sociologists have treated as nested, subordinate elements within systems are here conceptualized as separate systems. This enables us both to keep the notion of system, and the notion of systematic inter-relatedness, while yet not pre-specifying, in a rigid way, the nature of these inter-connections.

Each system, whether domain or set of social relations, can have a different spatial and temporal reach. Systems are over-lapping and non-nested. By this is meant that one system is not necessarily wholly contained by another; they do not have to be sub-sets in the way that is required within the notion of a system as made up of its parts. A system does not necessarily fully saturate the space or territory that it is in. This enables us to think of a set of social relations as not fully saturating an institution or domain—it can overlap with other sets of social relations.

Building the Theorization of Intersectionality

Two kinds of social systems need to be distinguished: first, institutionalized domains of economy, polity, violence, and civil society; second, sets of social relations such as class, gender, and ethnicity. The distinction between these two is developed from the distinction between institutional and relational structures noted and explored by López and Scott (2000). In their work institutional structures are the cultural or normative patterns that define agents' expectations and organize their actions, while relational structures are understood as patterns of causal interconnection and interdependence between agents and the positions they occupy. Here, the concept of institutional structure is broadened away from an exclusive focus on cultural and normative structuring, so as to include structuring associated with sedimented economic, political, and violent patterns of action.

By institutional domains, is meant an elaborated version of the conventional distinctions between economy, polity, and civil society. Each is a social system. To adequately address complex inequalities, some of the conceptualizations have been broadened. Thus the economy includes not only free

wage labor, but also domestic labor. The polity includes not only states, but also the European Union, organized religions that govern areas of life (such as personal life), and some nations (those with developed institutions, such as Scotland) (Walby 2003, 2004). The Gramscian concept of "civil society" is used in preference to culture, since it signals the contestations over the constitutions of meaning more effectively. A fourth domain is added, the violence nexus, since interpersonal violence is so important in the constitution of gender and minority ethnic relations and organized military violence is so important in the formation of nations and states.

Each set of social relations is a system. Examples of sets of social relations are those of class, gender, and ethnicity; each is a social system. Each of these sets of social relations is not flattened to a culturally reductionist concept of identity, or economically reductionist concept of class. Each set of social relations of social inequality is understood as a social system with full onto-logical depth, being constituted in the institutional domains of economy, polity, violence, and civil society. Not only are gender relations constituted in the economy, polity, violence, and civil society, but so also are ethnic relations and class relations. These systems of social relations are constituted at different levels of abstraction; one level is emergent from another. An individual will participate with a number of different sets of social relations.

These are overlapping, non-saturating and non-nested systems of social relations. Gender is not contained within class relations; they are not nested. Gender relations are a separate system; it overlaps with class, but neither gender nor class fully saturate the institutional domains.

One set of social relations rarely saturates a given institutional domain or territory. Rather different sets of social relations co-exist within institutions and within countries. This lack of saturation is a necessary part of the conceptualization of simultaneously existing multiple forms of inequality. Furthermore, a single institution, even a polity, rarely saturates the domain or territory in which it operates. Rather several institutions may co-exist, maybe in co-operation, or competition, or both. They may overlap, not sharing the same spatial or temporal boundaries. Social systems institutions should be conceived as non-saturating any given territory; they are porous and web-like (cf. Simmel 1955), rather than dense solids. The lack of saturation of any field by a single set of social relations or a single social institution opens the theoretical agenda that was prematurely closed by traditional systems thinking. It allows the possibility of analysis of multiple simultaneous complex inequalities, while retaining concepts of social structure and system.

The relationship between these domains is non-nested, since there is no presumption that there is a specific set of determinant interconnections

between them. This position is allowed for by the nature of the system/ environment distinction. In some circumstances the domains may be nested, but not in others. Sociological conceptions of systems have often over-stated the extent to which systems are nested. For example, the notion that a "society" in the modern era can be understood as a nation-state that contains nested economic, political, and cultural systems is widespread (Giddens 1990). However, this is theoretically and empirically erroneous: for example in the case of the UK there is more than one nation (Welsh, Scots, and some Irish as well as English); more than one relevant polity, since much economic governance is performed by the European Union rather than the UK state; and more than one cultural system since there is more than one religion (Christianity, Islam) as well as extensive secularization.

The overlapping and non-nested nature of social systems requires the re-working of the concept of social system, so as to allow for multiple sets of social relations in each institutionalized domain and of the intersection of social systems. The replacement of the notion of parts making up a whole by the notion of a system taking all others as its environment is essential to this theorization since it no longer insists that all inequalities directly map onto each other. Some may have a wider spatial and temporal reach than others, such as those of a minoritized diaspora associated with a previous colonial period.

"Societalization" Rather Than "Society"

One of the implications of this analysis is that social systems of gender, class, and ethnicity do not simply map onto each other, are not congruent, in the same territory. Neither are the institutional domains of economy, polity, violence, and civil society congruent in the same territory. They will often have different temporal and spatial reach.

The different temporal and spatial reach of a range of cultural "scapes"— ethnoscapes (persons); mediascapes; technoscapes (technology); finanscapes (global capital); ideoscapes—has already been noted (Appadurai 1996; Lash and Urry 1994). This is taken further in the argument here, since it is applied to polities, violence, and economies as well. The different spatial reach is not the same as deterritorialization, in which space loses its social significance (Brenner 1999; Scholte 2000), since space remains important (Harvey 1989; Sassen 1998). Rather it is a different way of thinking of the changing relevance of space.

The different temporal and spatial reach of these social systems challenges the conventional concept of a "society." Yet much sociological theory has presumed that its object of study is that of a society and that a modern society is a "nation-state" (Giddens 1990). It is necessary to go beyond the notion of a society in which economy, polity, and civil society and relations of inequality are congruent with each other in the same territory.

By contrast, a concept of "societalization" is preferred here. This is a process in which there is a tendency for these systems to be brought into alignment; a process that is rarely completed because it is usually interrupted by another competing system. Each societalization project is likely to contain different models for social relations associated with gender, ethnicity, class and nation. Each national project usually includes a project for a state of its own so as to ensure its preferred model of social organization including the economy, religion, and gender relations. However, few national projects are ever completed before a competing project interrupts. Most countries will contain more than one national project, competing or accommodating class, ethnic, and religious projects, and diverse gender projects. For example, the societalization project of the European Union introduces new principles of organization of class, gender, ethnicity, and nation that interrupt previous projects to societalize around would-be nation-states (Walby 2003, 2004). The process of societalization involves the restructuring of these institutional domains and complex inequalities, bringing them toward alignment. If there were to be the complete congruence of these systems, both institutional domains and sets of social relations, in a specific territory this would then be a "society." A focus on the analysis of globalization makes it clearer than previously that the social systems that are institutional domains and sets of social relations are rarely in sufficient alignment to be appropriately called a society, but the phenomenon itself is not new.

Emergence

Central to complexity theory is the concept of emergence that addresses the relationship between different levels, so as to address the potential problem of reductionism to either the individual or higher level of the system. The emergentist approach constitutes a fundamental rejection of the reductionism found in many types of natural and social science. The tendency to reduce, to seek the key explanation, at ever smaller units, whether individuals constituted as agents in social theory or genes in biological science, is rejected. Also rejected is any tendency to reduce in an upward direction, to a holism that

ignores individuals, or an ecology that ignores organisms. Rather than treating a system as reducible to its parts, a higher level emerges from the activities of lower levels of systems (Holland 1995), though whether this is better thought of as top down can be debated (Conte and Gilbert 1995; Gilbert 1995; Holland 2000). The problematic tendency toward either upward conflation to a high systemic level or conflation or reduction can be addressed using this formulation. Complexity theory approaches here parallel some of the developments in realist approaches to the structure/agency question (Archer 1995; Sayer 2000) and the work of Bunge (2001, 2004).

Coevolution

Some earlier notions of systems had difficulty in addressing social change and the relationship between different social systems. The relationship between systems is differently addressed using complexity notions. Rather than a simple hierarchical or nested relationship, complex adaptive systems coevolve, mutually adapting during the process. The conceptualization of the process of mutual adaptation is crucial to the theorization of the mutual constitution of complex inequalities that is so important for the analysis of intersectionality. Mutual adaptation, conflictual as well as more harmonious, takes place within changing fitness landscapes (Kauffman 1993).

Class, gender, and ethnicity are complex adaptive systems that coevolve in a changing fitness landscape. Gender relations coevolve in an environment that includes both class and ethnic relations. This environment, or fitness landscape, may be conducive to the development of one or other form of gender regime.

Path Dependency

Changes are not necessarily gradual. Complexity theory offers new ways of thinking about change in social systems, so as to theorize both sudden rapid major change that is the consequence of small events that may lead to path dependent trajectories in systems that are far from equilibrium, as well as the coevolution of complex adaptive systems (Arthur 1994; David 1985; Kauffman 1993).

Early conceptions of systems involved a presumption of a tendency toward equilibrium via negative feedback loops. Later conceptions of systems based on complexity thinking include, indeed focus on, positive as well as negative

feedback, and an interest in systems that are far from equilibrium. The differences have profound consequences for the nature of the analysis. Much sociological conceptualization of systems has been based on the early version of system theory (for example that of Parsons) and is highly problematic as a consequence, although there have always been alternative views (following some interpretations of Marx).

The concept of feedback is central to the idea of a system (Bertalanffy 1968). A feedback loop is: "a circular arrangement of causally connected elements, so that each element has an effect on the next, until the last "feeds back" the effect into the first element of the cycle" (Capra 1997, 56). A negative feedback loop entails a mechanism in which a change in one aspect of the system leads to a change in that mechanism which in turn leads to a change that restores the system to its original condition. A thermostat is an example of such a mechanism, responding to small changes in temperature so as to maintain the system at a near constant temperature. The concept of a negative feedback loop is associated with the notion of a system as tending toward equilibrium. Any change or perturbance to the system is met with a response internal to the system that restores it to the original state, that is, maintains equilibrium.

A positive feedback loop, by contrast, is a mechanism that drives small changes in a system onwards, escalating change. Thus, rather than restoring a system to equilibrium, positive feedback loops thus drive a system further away from equilibrium. The account of these positive feedback loops in economic systems (Arthur 1994; David 1985) profoundly challenged conventional economic analysis (Waldrop 1992), which had been predicated on the assumptions of tendency to equilibrium and on a declining return to investments. In this analysis small changes lead to large effects in a non-linear fashion. This can create path dependent rather than generic forms of development. Arthur (1994) argues that there can be multiple rather than a singular equilibrium point, that is, that it is possible for systems to be in equilibrium in more than one position. He argues further that the earlier the events that precipitate a shift in the system occur in a series of events the more important they may be.

Complexity theory accounts thus reject previous conceptualization of change as typically gradual and proportionate. Rather small changes may have large effects on unstable systems. Changes may be sudden, akin to processes of saltation, as a moment of crystallization of a new structure and form. The smallness and perhaps contingency of the event that precipitates these large-scale changes is inconsistent with many previous accounts of causality, and outside many simple forms of mathematical modelling based on linearity, being instead non-linear (Kauffman 1993).

Complexity theory emphasises the importance of non-linear changes; that small events can lead to large-scale changes in systems, for example, precipitating the bifurcation of paths of development. Within the natural sciences the example often cited (or imagined) is that of a small disturbance to the atmosphere in one location, perhaps as small as the flapping of a butterfly's wings, tipping the balance of other systems, leading ultimately to a storm on the other side of the globe (Capra 1997). Parallel examples from social science would be the new tax that precipitated a political revolution, or the assassination that precipitated a war. The lack of a proportionate linear relationship between cause and effect is troublesome for conventional science and its associated mathematics (Abbot 2001; Byrne 2002). Mathematical modelling has contributed much to the analysis of this phenomenon within complexity theory, especially through chaos theory, the analysis of the way that turbulent systems may suddenly bifurcate and resolve into two or more self-ordered entities. This entails non-linearity and lack of direct proportionality between cause and effect; this is not a gradual process, but rather one that can be sudden (Capra 1997).

Path dependency is a crucial process in understanding different modernities, different forms of social relations in different countries. Key to this are processes that lock-in certain paths of development, through their shaping of rewards, power, opportunity and knowledge (Arthur 1994; David 1985; Mahoney 2000; North 1990; Nee and Cao 1999; Pierson 2000). The processes of "lock-in" may take a variety of forms. One way in which lock-in has been addressed within economics is the theory of increasing, rather than decreasing, returns to scale, in which those entrepreneurs with an initial advantage, even if for contingent reasons, are able to set the path of development around a new technology in an economic system which is not in equilibrium (Arthur 1989). A slightly different, though overlapping approach, is one that focuses on the role of institutions, which affect the knowledge and opportunities of individuals (North 1990).

The concept of path dependency, originating in complexity thinking, is perhaps one of the more widely integrated complexity notions in contemporary social science (Esping-Andersen 1999; North 1990; Pierson 2000), although there remain questions (Liebowitz and Margolis 1995) especially about the precise nature of path dependency mechanisms (Mahoney 2000; Rihani 2001) and the extent of their sustainability over the long term (Nee and Cao 1999).

However, most of the applications of the concept of path dependency discussed above have focused on a single axis of inequality, usually class, with little attention, especially at a theoretical level, to the implications for

the analysis of the intersection of multiple social inequalities. Yet, there are divergences between the major paths of development in class, gender, and ethnic relations. The critical turning points at which new path dependent trajectories of development occur can be different for systems of class, gender, and ethnic relations. The critical turning points in the path dependent development of the different forms of gender regime occur at different times from those for class relations (Walby 2004, 2008).

Conclusions

Social theory faces a challenge in theorizing the intersection of multiple complex inequalities. To do so adequately it must address the ontological depth of systems of social relations of inequality in the institutional domains of economy, polity, violence, and civil society rather than flatten this to a single dimension of culture or economics. But the old concept of social system did not allow for more than one major axis of inequality in each institutional domain. This led many of those that prioritized the significance of multiple inequalities to reject the concept of social system. However, in so doing they lost the capacity to simultaneously theorize their ontological depth. To theorize simultaneously the ontological depth of each of these inequalities as well as their intersection it is necessary to revisit and revise the concept of social system, so that it can meet this challenge.

Complexity theory, which has developed across a range of disciplines, provides the conceptual toolkit that enables this to be done. While complexity theory is not a unified body of theory, it offers a series of conceptual innovations to the concept of system that may be synthesized with selected traditions in social theory. Within social theory, the focus here is on the Marxist and Weberian inspired heritage rather than that of Durkheim and Parsons that inspired Luhmann, to be able to address issues of inequality and power. This particular synthesis of classical sociology with complexity theory allows the transcendence of some of the old polarities of modernism and postmodernism. This is necessary to position concepts of inequality and power at the heart of social theory, a move that is necessary if the intersection of multiple social inequalities is to be theorized.

The selective adoption of complexity notions enables the revision of the concept of social system. The complexity notion of the system/environment distinction enables a more nimble conceptualization of systems and their interactions. This allows the rejection of the notion that a system must saturate its territory, enabling multiple systems of inequalities in the same space or

institutional domain. It enables the rejection of the notion that parts must be nested within a whole, and thus a rejection of the reduction of one set of social relations of inequality to another. Complexity theory provides the theoretical flexibility to allow systematic analysis of social interconnections without the reductionism that so marred the old. The re-working of these core concepts of social theory is necessary to adequately theorize the ontological depth of intersecting multiple systems of social inequality. The rethinking of the concept of social system is necessary to address this central issue in social theory.

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