Digital Technologies of Connection :

Modelling Individual and Societal Impact

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Abstract: Digital communication technologies, such as the Internet and mobile telephony, can be placed within a continuum of 'technologies of connection'. Such technologies alter the way in which individuals are connected, and may affect emergent social structures. In exploring the changes resulting from increased social connectivity, a number of useful approaches may be drawn from disparate disciplines. While network theory provides tools for describing connected structures, it fails to account for the complexity of individuals within a social system. Individual based modelling addresses this shortcoming, however both these approaches generally conceptualise systems as static. In understanding the ongoing effect of changes in social connectivity, it is necessary to appreciate social space as an unfolding metastable flux. Complexity theory suggests a dynamic, yet discontinuous model for the development of connected systems. This approach explores the qualitative changes brought about by increasing connectivity between individuals, resulting in a series of transitions through discrete emergent social states. A Deleuzian ontology of the virtual is proposed as a framework within which such studies can be situated. Structuring exploration around notions of virtual resources may deliver a greater understanding of the potential impact that digital connectivity will have on individuals and the social spaces they inhabit.

> Networks constitute the new social morphology of our societies, and the diffusion of networking logic substantially modifies the operation and outcomes in processes of production, experience, power and culture. (Castells, 1996: 500)

If, as Castells believes, "the network society represents a qualitative change in the nature of human experience" (508), it is important that we understand how such a transformation has arisen, and what forms such a society may take over time. In a networked world it is imperative to appreciate the nature of our interconnectedness, as individuals and society become increasingly inseparable, each reflexively defining and giving meaning to the other. One approach to answering such questions is to identify and analyse underlying patterns of change within the complex social network of individuals.

A number of approaches have been developed that are applicable to the analysis of such networks, within fields ranging from pure mathematics and ecology to computer science and philosophy. Following from the network ontology underlying the work of Castells and other writers (Delanda 1997; Deleuze and Guattari 1987), this paper aims to draw relations between several of these analytical tools, suggesting a somewhat transversal methodology for the study of social connectivity.

The pivotal role of connectedness is foregrounded in the study of 'technologies of connection' – means of connecting individuals both to each other, and to various social systems and resources. Most recently, these have included digital media such as the Internet and mobile telephony. Considering these technologies as elements of a continuum allows the appreciation of any resulting social change as part of an equally dynamic flow. The impact of digital media is not a single perturbation of a static society, but part of the field of influence guiding the unfolding of an ever-changing social flux.

The Social As Network

Employing usefully abstract Deleuzian terms, both the individual and the society can be described as 'machines' - systems of flow and interruption (Deleuze and Guattari 1972: 36). They are machinic forms at different spatial and temporal scales (Delanda 2002: 51). The societal machine (the 'socius') is composed of a rhizomatic mesh of individuals. In comparison to the fluidity of these individuals, the social has an illusory solidity, an illusion that melts when viewed within a geological timeframe (Delanda 1997: 258-259). The social is an enfolding of the individual; the two form a reflexive symbiosis (Giddens 1991: 2) whereby each creates meaning using resources drawn from the other (Castells 1997: 7-8).

The emergence of a social reality from the interplay between individuals requires that these individuals enter into relations with one another, and with parts of the societal machine. The formation of such inter-relating collections ('machinic assemblages') is facilitated by technologies of connection. While connective technologies (such as language) have existed and expanded from the first instances of the social, the advent of modernity has resulted in a dramatic growth in these technologies. Technologies such as the railroad, postal system, telephone, radio broadcasting, cinema, and air transportation (Gergen 1991: 49-53) have increased "the number and variety of relationships in which we are engaged, potential frequency of contact, expressed intensity of relationship, and endurance through time" (61).

Following these modernist technologies of connection, digital technologies constitute a second wave of connection, networking individuals together in ever increasingly complex ways. Mitchell suggests that "[c]onnectivity has become the defining characteristic of our twenty-first-century urban condition." (2003: 11) Digital technologies of connection provide us access to a larger number of more diverse individuals than previously possible. They allow us to maintain those connections both for briefer and longer durations, simultaneously, and across fragmented channels.

The impacts of digital technologies of communication are only now beginning to be felt. At an individual level, several researchers have warned of the further fragmentation and multiplicity of the self encouraged by digital connectivity (Slouka 1995: 35-58; Turkle 1995: 255-269). At a societal level, Castells has written extensively on the global transition to a 'network society', seeing the changes associated with information technology as a transformation of the social landscape of human life (1996: 1). Melucci concurs, analysing new patterns of social relations resulting from increases in the information density, transmission speed and processing power of digital technology (Melucci 1994, in Scribano 1998: 497). Such patterns should not be seen as consequences of technological change; rather the two are part of the same process (Castells 1996: 5).

In understanding the complex nature of these emergent patterns, it is useful to conceptualise the societal space as a "network of communications, which is added to the actors who carry it at the nodes" (Luhmann 1984, in Leydesdorff 1997: 26). In such a view, society is a network of molecular individuals, a 'mass' of undifferentiated connected nodes (Deleuze and Guattari 1987: 33). Individuals, however, are not static, defined singularities. They too are complex, dynamic meshworks of interconnection, articulated 'packs' of parts, extensive and divisible (33).

The emergent behaviour of these social networks is affected by their connectedness. While much previous research has been done examining change either at the level of the individual or at the level of the society, few fields have articulated both within the same theoretical construct (Renfrew 1979a: 7). Beyond a simple 'hybrid' approach, fewer still have attempted to explicate the relation inherent between the two levels, when perhaps giving form to the relational 'in-between' will provide the deepest understanding of the changes within the system (Massumi 2002: 70).

Network Theory

Networks have been a subject of study within mathematics for a considerable time. As an abstraction, networks can model many different real-world systems, reducing them to sets of nodes connected by sets of vertices. Much study into ecological and social networks has been done using mathematically constructed 'random networks' (Dorogovtsev and Mendes 2003).

A pivotal contribution to the applied study of networks was made by May (1972), who used network theory to suggest that as large systems increased in connectivity they would become unstable. He showed that increasing either the amount of interconnection, or the intensity of those connections, tended to result in instability within a system. Further, he showed that this effect grew more pronounced as the system grew larger. While purely mathematical, these results had significant ramifications for the study of a wide range of complex, highly connected systems. May's work drew on previous work by Gardner and Ashby (1970) who suggested that "all large complex dynamic systems may be expected to show the property of being stable up to a critical level of connectance, and then, as the connectance increases, to go suddenly unstable." (784) Within this context, instability refers to the tendency of a network to be extremely volatile to change. For example, May's model suggested that as a complex ecosystem becomes more interconnected – as various species come to be more tightly interdependent – the entire ecosystem becomes more prone to catastrophe as the result of environmental fluctuation.

Following May's conclusions, a number of researchers responded to critique his model or limit the implications of the work. Several studies found that within particular constraints, certain types of large networks could remain stable even when highly connected. (Haydon 2000; Rozdilsky and Stone 2001) This suggested that analysing 'random' mathematical networks ignored the constrained nature of real world systems that remained stable despite May's predictions. Other studies suggested that stability resulted not purely from the way individual nodes were connected to their neighbours, but also from larger structures within the network overlooked by May's model (Dorogovtsev and Mendes 2003: 11).

Perhaps the strongest criticism of network connection models such as those used by May, Gardner and Ashby is that they abstract all spatial and temporal heterogeneity of the constituent nodes and connections. Such models do not simulate the behaviour of nodes, merely the statistical behaviour of the system as a whole. While this provides considerable power in terms of analysing large systems relatively easily, recent developments in simulation and modelling suggest that alternative approaches may provide valuable insights. Numerous researchers (Drogoul and Ferber 1994; Kooijman 1994; Nowak and Latane 1994) have expressed the belief that to adequately model complex interacting systems, simulation must occur at an individual level. 'Individual based modelling' develops mathematical functions to describe the behaviour of individual nodes within a network and their interactions with other connected nodes. System level effects are observed as emergent behaviour when the activity of individuals is simulated. Such an approach may produce dramatically divergent results when compared to the abstractions of network theory.

Regardless of their differences, both modelling approaches tend to focus on developing models of a system as it presently exists, and exploring critical points beyond which that system structure is no longer stable. More holistic analysis of the impact of technologies of communication such as digital media requires models that see social structure as a dynamic flow.

Social Structure As Emergent Complexity

Several recent branches of mathematics have developed approaches to complex systems that explore underlying patterns without necessarily fully explicating them. These overlapping approaches include chaos theory, complexity theory, and catastrophe theory. Each of these suggests shapes for the complex behavioural flow of highly connected dynamic systems such as the societal change being discussed here.

While these approaches explain complex processes, they fail to provide a philosophical justification for the underlying structures they describe. Drawing on Deleuzian ontology, Delanda suggests that such structuration in physical processes is a product of ‘virtuality’, a space populated by “form-generating resources which are *immanent* to the material world.” (Delanda 2002: 10, emphasis in original) Understanding system behaviour within the model provided by Delanda goes beyond appreciating the system and its present behavioural shape. It involves mapping the cascade of ‘symmetry breaking transitions’ that will channel a system from one phase to another. This approach effectively steps back from picturing a society as a stable or unstable system, to see it as an ongoing process of metastable becoming.

Within any complex system, behaviour can be modified through a number of ‘control variables’ (Delanda 2002: 19). Often these variables can be described in ‘molar’ terms at the system level, or in ‘molecular’ terms at the level of the system’s constituents. Connectedness is one such variable. By modifying the level of connectedness of individuals within a society, and hence the level of connectedness of the society as a whole, the behaviour of the system will change. Associated with such a control variable are one or more 'critical values' (19). Moving the system through these critical values produces 'phase transitions', in which the system transforms from one structural state into another (Auyang 1998: 183). The transformation of ice to water and then to steam is an example of a series of phase transitions. Such a sequence of transformations may also describe the process of social change resulting from digital technologies of connection. These phase changes may be seen for example in structures such as economic institutions, the nature of governance, or the magnitude of social groups.

A concrete example of emergence can be seen in the formation of 'intermediate structures'. The dissolution of social institutions (Giddens, 1991) has prompted Melucci (1995) to explore the notion of 'collective identity' where, through networked connection, individuals form collective social actors that in turn form components of the societal machine. Between the individual and the socius lies a network of such collectives, structures that complexity theorists would describe as emerging "from the coherent behaviour of a group of strongly interacting constituents." (Auyang 1998: 151) The spatial and temporal scale of collectives falls between that of individuals and societies, creating assemblages that are "fluid and dynamic, forming and dissolving as constituents congregate and disperse." (Melucci 1995: 153)

The emergence of these new patterns of social structure is indicative of what Melucci sees as "the special relationship between change in complex society and the transformations taking place in the daily lives of individual subjects." (Scribano 1998: 496) Such collectives are also used by Castells to outline new forms of social identification and politics (1997: 7-9).

This process illustrates the way in which structure emerges from groups of closely and intensely connected individuals. With relation to these groups, digital technology often serves to dissipate certain local connections, leading to the potential dispersion of geographically defined collectives. Melucci emphasises the role of the 'planetarization' of the information society, resulting in the increasing fluidity of boundaries that had previously marked off such collective 'sub-systems' (Melucci 1994, in Scribano 1998:

498). This fluidity endangers the existing connections that produce intermediate structuration. Conversely, digital connection may provide networks for alternative collectives to emerge. In this way, one of the most readily apparent impacts of digital technologies of connection may be a transition in the nature of structuration in this intermediate space of collectivity.

Social Phase Transitions

As we develop and deploy technologies of connection, the increasing level of connectivity within society will result in qualitative structural changes. These have been observed in the past due to technologies such as the railroad, telephone, and television; they will continue in response to developments such as digital communication technology. As individuals become more connected, the social system passes through a cascade of symmetry breaking transitions. With each transition, elements of social structure are reconstituted (Renfrew 1979b), transforming from one metastable state to another. With each transformation the social space becomes less symmetrical and more striated, structuration becoming more complex and defined (Delanda 2002: 23-26).

This process of social 'differenciation' (Delanda 2002: 23) has been occurring at a gradual rate throughout history (Renfrew 1979b). The rate of change has accelerated considerably during modernity, due to increased connectedness that has driven more complex network behaviour. As digital technologies of connection push this curve to even steeper levels, transformations occur in ways that cannot be anticipated on the basis of previous behaviour. In the early nineties, Vinge hypothesised the imminence of a technological 'spike' – a transitional horizon of such dramatic technological change that forecasts are not possible beyond that point, based on our present worldviews (Broderick 1997). In a similar way, we may be approaching a social spike, a transition in social structuration so significant that we cannot discern the shape of the socius beyond it. In response to this, we must strive to understand the nature of the virtual singularities underlying the structuration of society today, and from this begin to extrapolate the cascade of transitions that will result from accelerated connectivity. Only then, by mapping the virtual space that will structure social space as we become ever more connected can we truly understand the social impact of digital technologies of connection.

References

Auyang, S.Y. (1998) *Foundations of Complex-system Theories in Economics, Evolutionary Biology and Statistical Physics*, Cambridge University Press, Cambridge.

Broderick, D. (1997) *The Spike*, Reed Books, Kew.

Castells, M. (1996) *The Rise of The Network Society*, 2nd edn, Blackwell, Oxford.

Castells, M. (1997) 'Communal Heavens : Identity and Meaning in the Network Society' in *The Power of Identity*, Blackwell Press, Oxford.

Delanda, M. (1997) *A Thousand Years of Nonlinear History*, London, Zone Books.

Delanda, M. (2002) *Intensive Science and Virtual Philosophy*, London, Continuum.

Deleuze, G. and Guattari, F. (1972) *Anti-Oedipus : Capitalism and Schizophrenia* (Trans. R. Hurley, M. Seem and H.R. Lane), Minneapolis, University of Minnesota Press.

Deleuze, G. and Guattari, F. (1987) *A Thousand Plateaus : Capitalism and Schizophrenia* (Trans. B. Massumi), Minneapolis, University of Minnesota Press.

Dorogovtsev, S.N. and Mendes, J.F.F. (2003) *Evolution of Networks : From Biological Nets to the Internet and WWW*, Oxford University Press, Oxford.

Drogoul, A. and Ferber, J. (1994) ‘Multi-agent Simulation as a Tool for Studying Emergent Processes in Societies’ in *Simulating Societies : The Computer Simulation of Social Phenomena*, (N. Bilbers and J. Doran Eds.), UCL Press, London.

Gardner, M.R. and Ashby, W.R. (1970) ‘Connectance of Large Dymanic (Cybernetic) Systems : Critical Values for Stability’, *Nature*, vol.228, p.784.

Gergen, K. J. (1991) *The Saturated Self: Dilemmas of Identity in Contemporary Life*, Basic Books, New York.

Giddens, A. (1991) *Modernity and Self-Identity: Self and Society in the Late Modern Age*, Stanford University Press, Stanford.

Haydon, D.T. (2000) ‘Maximally Stable Model Ecosystems Can Be Highly Connected’, *Ecology*, vol. 81, no. 9, pp. 2631-2636.

Kooijman, S.A.L.M (1994) ‘Individual Based Population Modelling’ in *Predictability and Nonlinear Modelling in Natural Sciences and Economics*, (J. Grasman and G. van Straten Eds.), Kluwer Academic Publishers, Dordrecht.

Leydesdorff, L. (1977) ‘The Non-Linear Dynamics of Sociological Reflections’, *International Sociology*, vol. 12, no. 1, pp. 25-45.

Massumi, B. (2002) *Parables for the Virtual : Movement, Affect, Sensation*, Durham, Duke University Press.

May, R.M. (1972) ‘Will a Large Complex System be Stable?’, *Nature*, vol. 238, pp.413-414.

Melucci, A. (1995) 'The Process of Collective Identity' in *Social Movements and Culture* (H. Johnston and B. Klandermans Eds.), University of Minnesota Press, Minneapolis.

Mitchell, W. (2003) *Me++ : The Cyborg Self and the Network City*, MIT Press, Cambridge.

Nowak, A. and Latane, B. (1994) ‘Simulating the Emergence of Social Order from Individual Behaviour’ in *Simulating Societies : The Computer Simulation of Social Phenomena*, (N. Bilbers and J. Doran Eds.), UCL Press, London.

Renfrew, C. (1979a) ‘Transformations’ in *Transformations : Mathematical Approaches to Culture Change*, Academic Press, New York.

Renfrew, C. (1979b) ‘Systems Collapse as Social Transformation: Catastrophe and Anastrophe in Early State Societies’ in *Transformations : Mathematical Approaches to Culture Change*, Academic Press, New York.

Rozdilsky, I.D. and Stone, L. (2001) ‘Complexity can enhance stability in competitive systems’, *Ecology Letters*, vol. 4, pp.397-400.

Scribano, A. (1998) ‘Complex Societies and Social Theory’, *Social Science Information*, vol. 37, no. 3, pp.493-532.

Slouka, M. (1995) *War of the Worlds : The Assault on Reality*, An Abacus Book, London.

Turkle, S. (1995) *Life on the Screen : Identity in the Age of the Internet*, New York, Simon & Schuster.