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# DISCUSSION

# Networks and learning: communities, practices and the metaphor of networks—a response

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I am pleased to have the opportunity to react to Bruce Ingraham's response to my article 'Networks and learning: communities, practices and the metaphor of networks' (Jones, 2004). It is rare to have a dialogue with someone who has taken the time and trouble to consider what you have written for a journal. All too often reviewing is a one-way process with the reviewer remaining anonymous. It is all the more pleasant to have a response to what you have written that gets to grips with some of the issues that the author also finds troubling. It is in that spirit that I write this reaction to Ingraham; it is an opportunity for me to develop some of the points he has identified as problematic in the original article. I want to concentrate on two main issues, firstly the network metaphor itself and secondly the usefulness of abstraction and representations of various types.

### The network metaphor

A fundamental question about the use of the network metaphor is whether we are dealing with networks as a kind of reified structure or topology or with networks as a process, a dynamic series of relationships. If we take a simple network structure, two nodes related by a single link, we might ask what that represents. The link may be sustained by heavy traffic, a more or less constant flow. On the other hand the link

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could represent a latent relationship, or a weak link, that could be activated but was only used for occasional communication. Mapping can include some minimal representation of such features, for example by colour coding links to represent types or levels of flow between nodes. There is nonetheless a fundamental difference between viewing networks as processes and reifying the process such that representations of process in topologies are taken to be the network itself. I am interested in topologies of networks and I am interested in mathematical 'laws' but I think of these as simplified and abstracted representations of process, indexes of activity, rather than as the phenomena itself.

Ingraham noted that:

> networks understood as a collection of nodes and links can be, and too often are, understood to be planer structures.

This has been a problem in the past but one of the attractions of the type of work being referenced in the article, for example by Barabasi (2002a), is precisely that it moves away from this two-dimensional view of networks that has been associated with random networks. I would recommend readers to examine some of the structures that emerge as representations of networks from the scale-free approach taken by Barabasi and his colleagues (see Barabasi, 2002a,b). For example, scale-free networks suggest an historical process of development in which scale-free networks develop in an ordered way over time in ways that are highly structured. In particular they form clusters, small numbers of nodes forming many links whereas a majority of nodes have few links, the development of such clusters implies the development of power relations. In short, scale-free networks are not two dimensional or even three dimensional as they incorporate at least a fourth dimension with the inclusion of time and social dimensions beyond that by introducing aspects of power relations.

Ingraham raises the question of what counts as a node in a network and points to my own use of node to represent individuals in a networked learning setting. Whilst I want to defend this usage I would also wish to point out that node can be applied at various levels in what may be described, like the Internet itself, as a network of networks. I would also want to point out that node in English derives from a biological reference to growth points in plants. In French the word used is 'nœud 'and derives from knot, suggesting a less particular interpretation of what a node might be. In English, node might imply a specific atomistic point, in French it implies a complex interweaving of links. Nodes can be collectives, organizations, sub-groups, regions etc. At a more microscopic level we might view individuals as networks of relations or even describe their physical constitution in network terms. This is one reason why the idea of a network topology is so appealing to me. Networks try to describe at a high level of abstraction the interrelationships between different forms. Scale-free networks are found to be good descriptions of a wide variety of phenomena at various granularities of description. As a central strength this can also be seen as a weakness. Indeed, Ingraham asks me to be more precise about what thoughts the network metaphor produced in me. This is a very reasonable request as the level of abstraction could easily hide a limit to any grounded application to learning with networked technology.

The ideas of community and in particular communities of practice are a common metaphor applied to networked learning. A problem with this view is that community implies close relationships between participants and a certain unity in relation to the community itself. Indeed, Wenger addresses this problem by introducing the notion a constellation of practice, consisting of a number of communities of practice and less intense interaction between members of a constellation than within a community (Wenger, 1998). My own view is that networks may provide a better way of conceiving of many of the relationships found in learning. Brown and Duguid have introduced the idea of a network of practice to describe some types of relationship (Brown & Duguid, 2001). For Brown and Duguid, extended epistemic groups are held together by a common substrate of practice and networks identify a significantly looser set of relationships than those within a community of practice. A specific grounded piece of research flowing from the network metaphor would be to explore empirically the relations found in technologically assisted learning. The aim of such an exploration would be not to impose either the network or community metaphor, but to provide descriptive accounts of the kinds of relationships that are found in such settings and see in what ways if any either metaphor illuminated such descriptions.

## The usefulness of abstraction and representation

Ingraham comments that the notion of developing mathematical laws alarms him but towards the close of his commentary he refers to fractals and complex and chaotic systems. I think this reference helps me to understand what kind of relationship between mathematical laws and descriptions I am trying to indicate. Fractal geometry uses a set of general principles or laws in order to describe a wide variety of phenomena and I think this approach provides a valuable additional resource for describing networks not an alternative as Ingraham suggests. At its simplest fractal geometry relies on abstract reasoning to generate fractional dimensions (Gowers, 2002, p. 82). Fractal geometry provides mathematical rules that define the conditions for the generation of particular shapes that have a self-nesting property such that shapes can be built up of smaller copies or approximations of the original shape. Fractal geometry is highly evocative of social and natural organization and can be used to generate computer graphics simulating natural phenomena such as plant growth and cloud formations. Unlike Ingraham, I do not see fractal geometry as an alternative metaphor to networks I see it as complementary and a reinforcement of the idea that mathematics, including mathematical laws, can be used as indexes to social processes. Fractal geometry is an example of why, just as with scale-free networks, we may wish to investigate mathematics not simply as metaphor but also in terms of 'laws' and a method resting on abstraction (see Gowers, 2002).

Ingraham offers the metaphor of a rhizome following Deleuze and Guattari (1976) as a further alternative to networks and notes that:

> if one focuses attention on the activity, on the 'social process', we may find that the topology of cyber relations is rhizoid rather than racinated.

Rhizome as used by Deleuze and Guattari is indeed a metaphor that emphasizes network like features:

> To these central systems, the authors counter-propose a-centric systems, networks of finite automata in which communication flows from one neighbour to the other, in which all individuals are interchangeable and are defined only by a state in a particular moment, in such a way that local operations can be coordinated and the final result can be synchronized independently of a central body. (Deleuze & Guattari, 1976, p. 50)

In some ways the rhizome metaphor by focusing on automata suggests a fusion of the kind made in actor network theories between human and non-human actants. It is also a metaphor that is currently applied to networked learning in higher education (Raschke, 2003, p. 8). On the other hand, despite its careful use by both the original authors and recent advocates, rhizome remains, like racine, a root based metaphor and inevitably carries with it biological notions and an image of transport in and out of a system. Roots, however fine and interwoven, are transactional systems sustaining a living organism and the transactions are largely one way and only partially interactive. I think Ingrahams' preference for rhizoid over racinated relates to his planer view of networks. He identifies the bifurcating pattern of racination with a network, whereas I do not and I think of networks as multi-dimensional phenomena that can be abstractly represented in three or four dimensions only by significant reduction and abstraction.

## Conclusions

The network metaphor is not new and clearly carries with it a certain baggage from previous uses. However, I think the recent advances in understanding complex networks provides learning technology with an opportunity to draw together a variety of theoretical sources in a productive way. I agree with Ingraham that the actual activity of what he calls internetworking is the core of our mutual interests but I think our difference lies in how much we believe the use of a network metaphor and mathematical approaches to networks can be productive in exploring this activity.

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