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From network to meshwork: Becoming attuned to difference in transdisciplinary environmental research encounters

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ABSTRACT

Transdisciplinary research has been promoted as a means of bringing together certified experts and stakeholders to produce knowledge that is policy-relevant, salient, credible, and legitimate to inform decision-making about complex problems. In this article I discuss the limitations of using the 'network' metaphor in transdisciplinary research practice and propose the use of a different metaphor to make transdisciplinary research encounters more attuned to difference. This research is informed by Tim Ingold's use of 'meshwork' as a metaphor for how life is lived along lines of becoming: emergent, indeterminate, contingent, historical, narrative. In this paper, my objective is to explain and illustrate by way of an example of a transdisciplinary climate change adaptation project the need for a new metaphor to convey the open-endedness of transdisciplinary research where subject positions are not conceived in advance of a research encounter, such as in the 'network' metaphor, but erupt in the interstices of research methods, objectives and desired outcomes. The meshwork metaphor implies that transdisciplinarity should be reframed as a practice of attunement to difference, becoming skilled in paying attention, witnessing, and responding to differences.

1. Introduction

To suggest that we live by metaphors means understanding that the term 'metaphor' does not refer simply to how we speak, or the words we use, but involves conceptualization and reasoning: Metaphors shape what we think and how we act, and they make different worlds possible (Lakoff and Johnson, 2003). Some metaphors are very useful in helping us understand how separate things can be connected and to what effect, such as the 'network' metaphor. For example, researchers might say they 'network' to access local knowledge and other expertise; to encourage cross-fertilization across disciplines, institutions, and locations; to share tacit knowledge about a technique; to pool knowledge to address large and complex problems and foster innovation; and to increase scientific reliability and the probability of success (Groß and Stauffacher, 2014; Klenk and Meehan, 2015). Research networks have shown great promise as decentralized approaches to the generation and uptake of policy-relevant knowledge. Groß and Stauffacher (2014) noted that the increasing pressure on scientists to apply their findings, has resulted in scientists being encouraged to engage in more participatory forms of networking and knowledge production.

Both long established and newer international research and engagement platforms such as the Consultative Group on Agricultural Research (CGIAR) and Future Earth rely on networks that engage local stakeholders and decision-makers to address environmental problems (van der Hel, 2016; Lahsen, 2016). In their networked processes, they generate collective objectives, identities, and social imaginaries to test a path of action and envision desired future social, material, and political outcomes (Stengers, 2000; Callon et al., 2011). Because knowledge is assembled in multiple ways within such research networks, imagined futures that emerge from these processes also vary. The extent to which such research networks permit alternative paths of future development depends in part on whether stakeholders are empowered to shape research in a way that can challenge global framings of environmental issues, governance, and solutions (Liverman, 2009; MacGillivray, 2015).

Although the 'network' metaphor is useful to understand who and what connects to produce knowledge in stakeholder-engaged research practices, it is important to remember that the use of metaphor in science is always accompanied by an important disclaimer: scientific metaphors are not mirror images of reality – they are interpretive and constructive heuristics. Because of this provisional nature of metaphors in science, and changing historical contexts and needs, better metaphors can be deployed to improve understanding of transdisciplinarity. Indeed, the metaphor of 'networking' does not incorporate all of the work involved in collaborative research involving stakeholders and may limit possibilities for emergent processes and unexpected (un)

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desirable outcomes and homogenize individual trajectories and the development of common plausible futures.

In this paper, my objective is to explain and illustrate using an example of a climate change adaptation project the need for a new metaphor to convey the open-endedness of stakeholder-engaged research and the obligations it calls forth. Using the Charlotte County Climate Change Community Vulnerability Assessment (CCCVA) as my case study, I propose the 'meshwork' metaphor to describe research practices that are more responsive to the unique pattern of relations that are encountered during research.

A 'meshwork' metaphor can help explain how individuals and knowledges are 'entanglements' that emerge through encounters with others. Ingold (2011) built on the work of Deleuze and Guattari (2004), arguing that rather than understanding social life using the 'network' metaphor, we should understand social life as being lived along 'lines of becoming.' Life is lived not within the perimeter of a network, but along lines that 'open' even as they get entangled with the lines of others. These lines cross other lines of becoming and critically, they do not connect:

> A line of becoming is not defined by the points it connects, or by the points that compose it; on the contrary, it passes between points, it comes up through the middle, it runs…transversally to the localizable relation to distance or contiguous points. A point is always a point of origin. But a line of becoming has neither beginning nor end. (Deleuze and Guattari, 2004: 224–225)

Ingold went on to propose using the 'meshwork' metaphor to characterize the trails along which life is lived, which include histories, stories, and trajectories that are full of loose ends and are always on the move:

> In the meshwork, each constituent line, as it bodies forth, lays its own trail from within the interstices of its binding with others. Thus the joining of lives is also their continual differentiation. The knots formed in the process are not inclusive or encompassing, not wrapped up in themselves, but always in the midst of things, while their ends are on the loose, rooting for other lines to join with. (2016: 11)

The 'meshwork' metaphor has been used in other fields of study, including sociology (Tironi et al., 2014), geography (Jones, 2013; Payne, 2018; Vannini and Vannini, 2018), education (Tamboukou, 2008; Burnett, 2016), and archeology (Carter, 2017). However, to my knowledge it has not been elaborated as a useful metaphor to describe stakeholder-engaged research. In the following section I will explore how the 'network' metaphor has been used to characterize participatory environmental research in a way that is static and only recognizes predetermined types of differences (e.g., social network positions, structural features of whole research networks). I then describe how the 'meshwork' metaphor may sensitize researchers to the value of emergent outcomes, differences between research objectives and unintended consequences, and relational skills of encountering, witnessing, and responsiveness.

2. Transdisciplinary environmental networks

Over the last 40 years, the traditional model of science led by individual researchers has evolved into various models of 'big science,' as illustrated by the development of large research networks (connecting people, resources, institutions) such as the CGIAR and Future Earth. These research networks facilitate collaborative research efforts to address complex problems that are not amenable to individual research (Callon et al., 1992; Trochim et al., 2008). A number of conceptual models have emerged to characterize collaborative research involving stakeholders to address complex environmental problems: 'Mode 2' (Gibbons et al., 1994; Nowotny et al., 2001), 'triple-helix' networks involving universities, governments, and private sector partners (Etzkowitz and Leydesdorff, 2000), and 'post-normal' science (Funtowicz and Ravetz, 1993). What these models have in common is the objective of transcending academic and institutional boundaries to produce knowledge whose quality and utility should be assessed by a broad epistemic community including certified and non-certified experts. These models all fall under the broad umbrella term of 'transdisciplinary' research. By connecting actors across such boundaries, transdisciplinary research is assumed to yield policy-relevant solutions to complex societal problems (Klenk and Meehan, 2015).

The idea that transdisciplinary research collaboration is an example of 'networking' to produce knowledge is appealing analytically, because the 'network' metaphor enables the quantification and characterization of social relationships using social network analysis (SNA) techniques. These SNA techniques have been used to examine many different fields of collaborative research, including environmental health (Ginexi et al., 2017), water research in Europe (Heringa et al., 2016), long-term ecological research in the US (Johnson et al., 2010), and structural position and scientific performance among health researchers in Canada (Contandriopoulos et al., 2016). A full review of these analyses is beyond the scope of this article, but they illustrate how the network metaphor is helpful for those analyzing transdisciplinary research.

Briefly, SNA techniques allow researchers to examine the overall structure of research networks, the subgroups formed within the total network, and the 'nodes' (actors) and 'links' (relationships) that comprise the network (Burt, 2000; Knoke and Kuklinski, 1982; Scott, 2000; Wasserman and Faust, 1994). Several measures relating to an individual's network of collaborators can clarify the development of his or her social capital and citation impact (Wang, 2016). For example, the number of connections ('degree centrality') can represent the extent to which one is important or powerful within a research network. Actors may also be characterized as 'brokers' because they are situated between other, non-connected researchers and thus control the flow of information through the network; as 'isolates' because they have no connection to any other actor in the network, or as 'cutpoints' because their removal from the network breaks up connections between various groups or individuals (Contandriopoulos et al., 2016).

Focusing on the overall structure of an entire research network can also clarify how social capital might be mobilized to achieve particular research goals (Ekboir et al., 2017). Network measures can include 'density' (the number of all possible connections among individuals) and 'centralization' (the extent to which a network is dominated by a single or a few highly connected individuals, hence reflecting a hierarchical distribution of power). Other network measures may focus on the number and structure of subgroups within a network, such as 'cliques,' which are thought to enhance the quality of collaboration because individuals within cliques work closely together, share norms of conduct and expectations, and are subject to sanctions when their behavior is against group norms.

Another measure of an overall network involves the 'small world' structure (Milgram, 1967; Watts, 1999). A 'small world' is a network in which dense clusters of actors are spanned by 'bridges' that connect the clusters. Large networks may be sparsely connected, but the presence of actors that bridge disparate clusters will result in a relatively small number of links connecting all individuals in the network. This concept of 'small world' network has gained attention in terms of evaluating research, because such networks are thought to improve the potential for innovation in scientific fields (Baum et al., 2003; Cowan and Jonard, 2004; Uzzi and Spiro, 2005; Watts, 1999), although evidence for this is sparse and sometimes contradictory (Fleming et al., 2007; Opsahl et al., 2017).

Thus, the 'network' metaphor can help us understand how different connections between people (or institutions) in research networks produce knowledge and innovation by linking 'star' researchers, knowledge brokers, and peripheral researchers, or engaging the 'right' stakeholder at the 'right' position within the network. However, its application is more problematic when it comes to understanding the