Faculty of Design

2016

Knowledge visualization in environmental communication capturing politicized debates with discourse mapping

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Knowledge Visualization in Environmental Communication
Capturing Politicized Debates with Discourse Mapping

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Abstract

Mapping controversies on environmental issues is a good starting point for learning about their complexities. One way to accomplish this task is through discourse mapping. Discourses are shared ways of understanding the world. Diverse values, vested interests, critical perspectives and insights are embedded within discourses. These both reflect and construct attitudes towards the natural world. Discourse mapping is an interpretative method that can reveal political strategies, ideologies and tactics. In displaying the distinctions between discourses, the outlines of controversies are clarified. This paper contributes to a theory of knowledge visualization and presents two discourse mapping projects (one completed project and one that is in its initial stages) on environmental themes: *Mapping Climate Communication* (2014) and *Mapping Degrowth* (2016 - 2017). Knowledge visualization captures meaning lost with more reductive visualization methods.

Introduction: Visualising Wicked Problems

Environmental problems are typically wicked problems that are difficult to solve and also difficult or impossible to objectively define (Rittel and Weber 1973). Since the very definition of many environmental problems depends on how they are understood, the controversies that emerge in attempting to define and address them are sites of intense debate. Definitions vary according to diverse perspectives and ideologies. These various ways of understanding environmental dilemmas underlie different approaches towards the development and design of solutions. One way that environmental communicators and theorists deal with this problem is by identifying distinct environmental discourses. Political scientist John Dryzek's seminal work *The Politics of the Earth* (2013) is one of most comprehensive overviews of the dominant environmental discourses (i.e. approaches to environmental politics). The social science based method of discourse analysis can be enhanced with design methods and visual mapping techniques. Discourse mapping is a type of knowledge visualization that enables deep-reaching examination of the social and political circumstances and ideas associated with environmental problems. It can reveal obscured assumptions. Discourse mapping offers a means of analyzing and ultimately challenging dysfunctional assumptions and ideologies by making distinct discourses visible and highlighting dynamics, tensions and problems associated with various discourses.

Effective responses to environmental problems demand negotiating options and taking diverse perspectives and sets of interests into account. Revealing how discourses are linked to ideological commitments and often concrete interests can be a starting point for learning on the level of system structures and paradigms. By revealing distinct discourses, discourse mapping makes it possible to review different perspectives on the same problem. Often solutions require taking a new perspective. In her famous text: 'Leverage Points: Places to Intervene in a System' (1999) systems

theorist Donella Meadows described a hierarchy of leverage points to encourage increasingly effective systems change. Discourse mapping is a type of knowledge visualization that enables analysis on the level of ideologies, system structures and paradigms. Designers, with expertise with visualization, are especially well suited to use systems practices to respond to wicked problems with designerly approaches that "synthesise solutions from complex and fuzzy material" (Sevaldson 2013, 1). On politicized issues of controversy, systemic and critical approaches are necessary.

Critical Information Visualization

Discourse mapping is a visualization method that responds to the limitations of other approaches used to visually communicate environmental information. For example, all too often data visualization functions in obscuring ways on complex and political problems. Data visualization does powerful political things whether or not producers and audiences themselves are aware of the political work that is being performed. My recent paper offered an overview of how data visualization reflects power relations, special interests and ideologies (2016). In this paper, I presented three terms to unpack the various ways that data visualization works to obscure complexity:

> **Datawash:** Where data visualization techniques obscure knowledge on issues of controversy (Boehnert 2015).

> **Dark data** is the missing data. Where certain data is not collected, this is often due to the epistemic and ideological assumptions of powerful constituencies – or simply where the communication of certain data is against their interests (Corby 2015, Boehnert 2017).

> **Digital positivism**
> Where complexity is reduced to numbers and certain types of knowledge are prioritised as the expense of others (Mosco 2014).

These ideas summarize some of the reasons that data visualization has been described as "one more powerful and flawed tool of oppression" (D'Ignazio 2015, para. 2). In her work on feminist data visualization, Catherine D'Ignazio asserts that data visualization makes a particular perspective seem like "an expert, neutral point of view" (2015, para. 1). Yet data visualization is always a representation of a situated perspective. As such it reveals some observable facts while simultaneously concealing other realities. In a world with dramatic power imbalances, this partial perspective means that some people's interests are represented at the expense of others. Theorizing what goes wrong with data visualization provides a basis for the development of more effective visualization practices on issues of controversy.

Knowledge Visualization

Designers concerned with the development of nuanced and critically aware ways of approaching complex and politicized topics are developing new visualisation practices. Visualisation can facilitate the generation of new perspectives with cross disciplinary analysis and problem-solving. This work shifts the focus from the final artefact, to the *process* of knowledge generation:
> "From a designer's perspective visualizations represent the process that moves from data to knowledge, where each visualization is seen as a transformation artifact within the data-information-knowledge continuum… In this perspective visualizations are not merely final outcomes of representing data, information and knowledge. Instead they have to be conceived as transformation processes" (Masud, Valsecchi, Ciuccarelli, Ricci and Caviglia 2010, 446).

This transformative process occurs in a 'data-information-knowledge continuum'. Communica-tion theorists describe four categories of communication: data, information, knowledge and wisdom. These are listed here in a hierarchy from reductive/disparate to holistic/integrated:

Data are the pure and simple facts without any particular structure or organization, the basic atoms of information,

Information is structured data, which adds meaning to the data and gives it context and significance,

Knowledge is the ability to use information strategically to achieve one's objectives, and

Wisdom is the capacity to choose objectives consistent with one's values and within a larger social context

(Logan and Stokes 2004, pp.38–39 quoted in Logan 2014, para. 35).

Information designer David McCandless organized these four categories on a triangle in his *A Hierarchy of Visual Understanding? v 0.1* (figure 1). This diagram displays understanding as enhanced by increasing organization and meaning (with 'data' as the least – and 'wisdom' as the most organized / meaningful). McCandless assigns terms to the various types of practices associated with visualizing different types of information: visualization, design, mapping, ?? (presumably by '??' he refers to as an emergent practice still undefined). McCandless also lists relevant verbs (i.e. embody, synthesize, structure, interpret, evaluate, contextualize, compare, connect, order, categorize, calculate, collect etc.) and examples (belief systems, paradigms, systems, chapters, theories, axioms, conceptual frameworks, concepts, ideas, words, numbers, etc.). This model links information theory to visualization practices to describe levels of communication in information visualization.
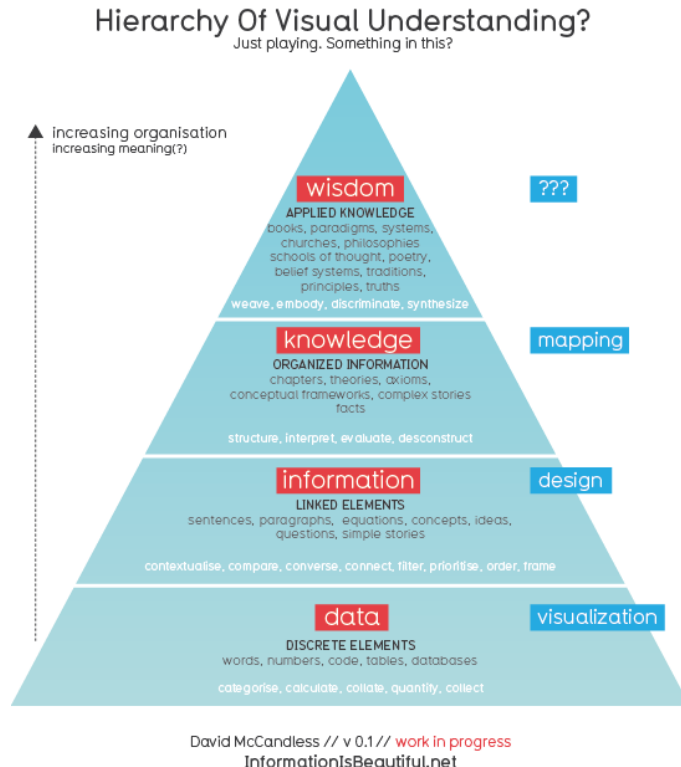

Figure 1. David MacCandless. 2010. *Hierarchy of Visual Understanding*. v 0.1. Information Is Beautiful. *http://www.informationisbeautiful.net/2010/data-information-knowledge-wisdom*

Data visualization is reductive. Data is everywhere but in focusing on any particular dataset, one's perspective is reduced to one type of information (often captured with numerical data, with quantification processes that lose information as they reduce complex phenomena to a number). This focus in data visualization determines that only certain aspects of a problem are presented. This emphasis on one set of data neglects other possible datasets and so the representation is always partial. Data visualization reflects the assumptions of its producers (in terms of which data is chosen and how it is presented). While all visualization techniques reflect ideas of the people involved in production, data visualization is a practice where this partial view is often obscured and presented the authoritative perspective – as well described by D'Ignazio (2015). In order to emphasis this reductive characteristic data visualization, I flipped the triangle (Figure 2). Knowledge visualization offers more integrated, systemic and meaningful approach to complex topics than data visualization as it increases the organization of complexity of information and communicates on the level of meaning. These two triangle models draw on information theory to illustrate emergent types of visualization. Knowledge visualization techniques such as controversy mapping and discourse mapping offer more nuanced approaches to capture complexity. These expansive approaches avoid over-simplifying complex issues – but they also present significant challenges to designers and other producers in terms of the depth understanding necessary to present these overviews.
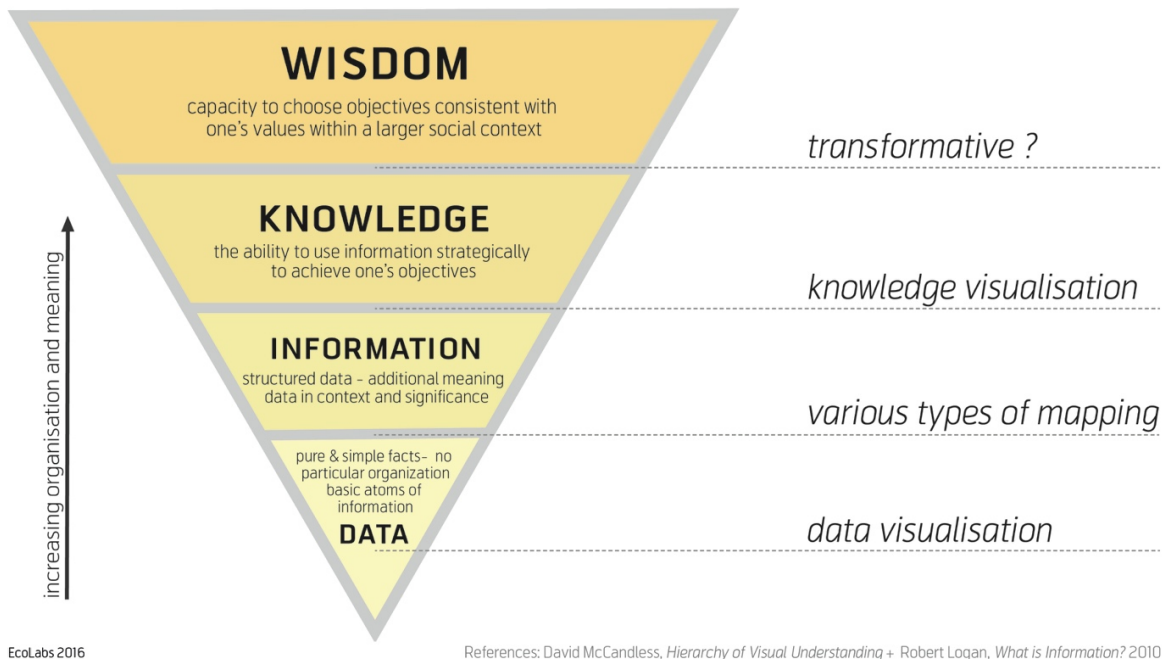

Figure 2. EcoLabs, J. Boehnert. 2016. *Wisdom / Knowledge / Information / Data Visualisation Triangle*.

As information processing moves from the level of data to knowledge, the information becomes increasingly meaningful and actionable. "Knowledge Visualization artefacts [are]…. experiential and actuative– getting someone to get action – dimension is the main feature of this discipline" Masud, Valsecchi, Ciuccarelli, Ricci and Caviglia 2010, 447). Knowledge visualization facilitates deeper types of learning that are typically necessary for agency and action on new information on difficult topics such as the environment.

Controversy Mapping

The *Climaps* by EMAPS project was a large-scale research project funded by the 7th Framework Programme of the European Union. The *Climaps* project published 33 issue-maps on climate change and the annual United Nations Framework Convention on Climate Change (UNFCCC) Conference of all Parties (COP) negotiation process in 2014. *Climaps* is the largest yet experiment with the method of controversy mapping. The project's 'A Summary for Policymakers and Busy People in General' describes the controversy mapping method:

> "Controversy mapping is a research technique developed in the field of Sciences and Technology Studies (STS) to deal with the growing intricacy of sociotechnological debates. Instead of mourning such complexity, it aims to equip engaged citizens to navigate through expert disagreement. Instead of lamenting the fragmentation of society, it aims to facilitate the emergence of more heterogeneous discussion forums" (Venturini et al. 2014, 1).

This series illustrates trends over time with data visualization, network visualizations, flow diagrams, treemaps, scatter plots, and other (often interactive) visual strategies. The issues maps aim to "provide users with background knowledge to allow them to freely explore the results" (Mauri and Ciuccarelli 2016, 10). The series reveals an overview of controversial issues. What the work does not do is reveal the politics of the UNFCCC and COP processes. Within climate communication there are very different discourses that reflect different ways of understanding political problems and different types of proposed solutions. These distinctions have political consequences. For example, Figures 3 illustrates topics under discussion at the annual UNFCCC annual conferences and Figure 4 displays the funding priorities for various nations. What is not revealed are the various political approaches to the topics. In the highly politicized context of climate communication, these distinctions matter because they represent vastly different proposals for action.
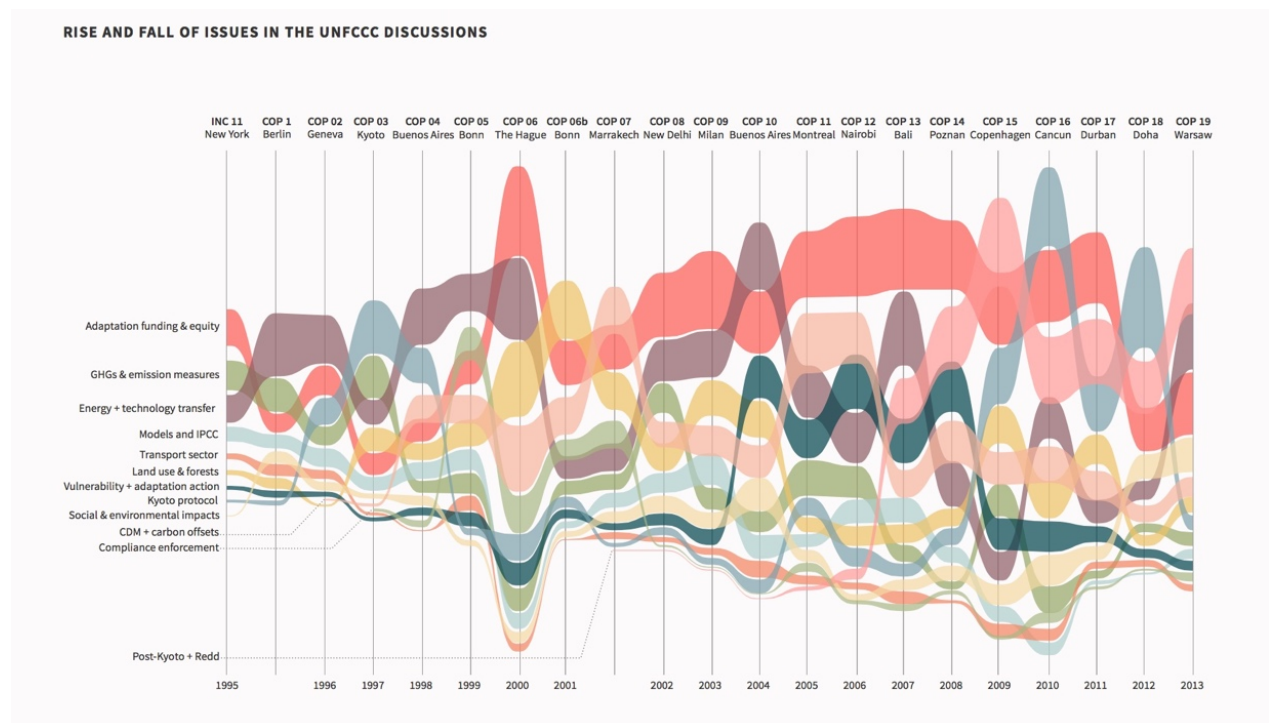

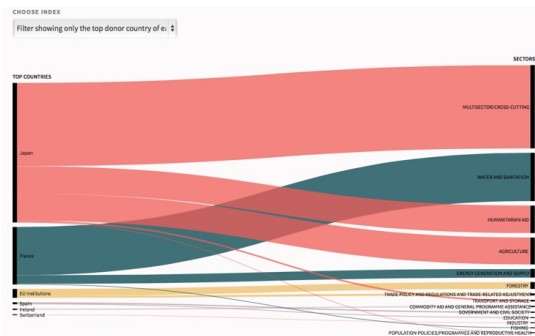Figure 3. *'Climaps by Emaps: Rise and Fall of Issues in UNFCCC Negotiations, 1995-2013'. http://climaps.eu.*

Figure 4. *'Climaps by Emaps', Sectorial Specialization of OECD Member Countries. http://climaps.eu.*

Discourse Mapping

Discourse mapping[1] is an interpretative method that reveals political agendas, diverging worldviews and ideological assumptions. It is a visualization approach that reveals the ideas that underlie various approaches to environmental problems. Discourses are shared ways of understanding the world that provide the basic terms for analysis and define what is understood as common sense and legitimate knowledge (Dryzek 2013, 9). Diverse values, vested interests, critical perspectives and insights are embedded within discourses. These both reflect and construct attitudes towards the natural world (and by extension: climate change). In displaying the relationship between discourses, the outlines of the controversy are illustrated. This work can highlight assumptions that are obscured by epistemological and ideological blindspots inherent within more reductive visualization practices. Ultimately discourse analysis and discourse mapping aims to provide insights to make transformative social and political change possible.

Mapping Climate Communication (2014)

Mapping Climate Communication uses discourse mapping to offer an overview of how climate change is communicated in the public realm by visualizing and contextualizing actors, events, actions and discourses influencing public opinion. The *Climate Timeline* illustrates major milestones in climate communication and politics over fifty years. It also displays the historical processes and events that have led to the growth of various ways of communicating climate change. The *Network of Actors* illustrates relationships between actors participating in climate communication in Canada, United States and the United Kingdom. Together the two posters map five climate discourses: climate science, climate justice, ecological modernization, neoliberalism and climate contrarianism. Since communication happens at the level of rhetoric as well as the level of action, discourses in this project include explicit messages and also messages that are implicit within political, corporate and organizational activities and policy. This approach reveals tensions and contradictions in climate communication. The objectives for the two maps are listed below.

> *Climate Timeline* - Objectives:
> • Display the major milestones in climate communication over the long and the short term
> • Display the significant growth of the climate contrarian movement and its impact on other discourses
> • Display how events correspond to media coverage and trends in coverage over time
> • Display how events are contextualized within five discourses and trends in these five discourses
> • Reveal historical discursive obfuscations by highlighting the differences between what was said by powerful actors and what was done

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[1] I developed the discourse mapping method as part of my Mapping Climate Communication research during my CIRES Visiting Research Fellowship at the Center for Science and Technology Policy Research, University of Colorado Boulder.
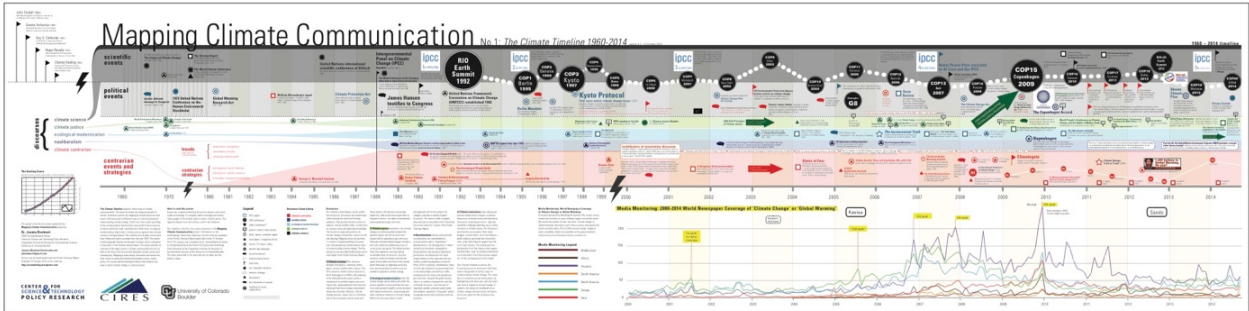
Figure 5. J.Boehnert. 2014. *Mapping Climate Communication No.1: The Climate Timeline 1960-2014*.

Network of Actors - Objectives:
• Display the wide variety of actors in climate communication
• Display the relationship of actors to each other and within five major discourses
• Collect and display information on these actors in meaningful ways
• Explore relationships between discourses (especially the neoliberal discourse and other discourses)
• Explore the impact of neoliberalism on climate communication
• Develop the concept of discursive confusion and illustrate contradictions
• Open discursive space for the climate justice discourse
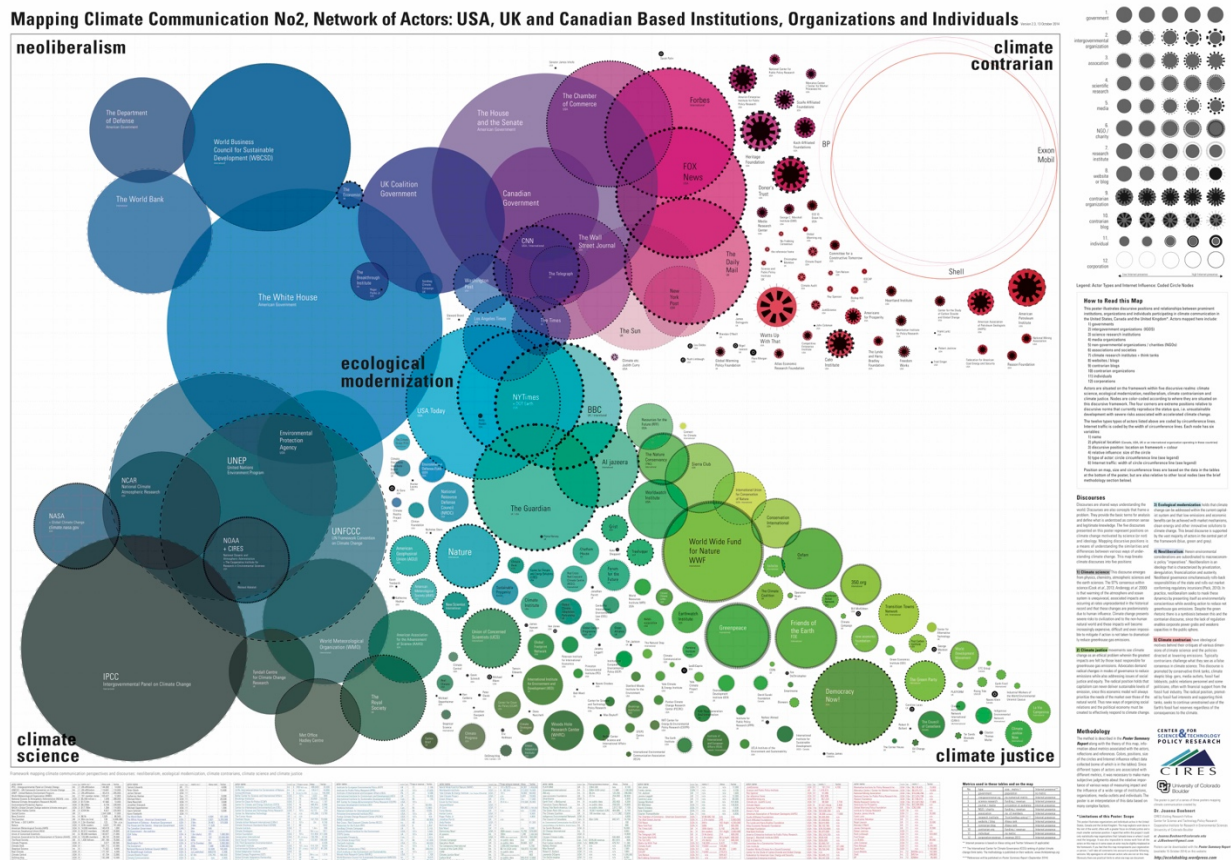

Figure 6. J.Boehnert, 2014. *Mapping Climate Communication No.2: Network of Actors: USA, UK and Canadian Based Institutions, Organisations and Individuals*.

The concept of discursive confusion was developed to illustrate conflicts and obfuscations in climate communication. The timeline displayed contradictions between what was said and what was done about climate change. For example, the neoliberal discourse uses the rhetoric of the ecological modernization discourse but aligns itself with the contrarian discourse in policy and support for fossil fuel intensive industrial infrastructure. Neoliberal actors (in government and elsewhere) claim that climate change is a serious threat, but continue to support carbon intensive development.

The *Network of Actors* was significantly more popular online than the *Climate Timeline* online (*Network of Actors* had 138,000 views in the first 2 months whereas vs. the *Climate Timeline* had only 5,000). The *Network of Actors* was designed using a more interpretative method (where actors were placed on the matrix according to my analysis of their discursive positions) than the *Climate Timeline*. I received reports that the *Network of Actors* generated significant debate in institutional contexts and especially with people working at NGOs represented on the matrix. This result demonstrates an interest in the highly interpretive method used in the *Network of Actors*.

Mapping Degrowth in Environmental Movements (2016 – 2017)
The Mapping Degrowth project will provide an overview of the degrowth movement that has been steadily growing over the past decade into a significant discourse in environmental politics and ecologically informed economic theory. Previously existing visualization research in the degrowth literature includes James Vandeventer's "Conceptualising the Degrowth Niche: An interdisciplinary study using bibliometrics and the multi-level perspective framework to explore the degrowth field" (2016) that maps dominant actors in the field (Figure 7). My preliminary timelines (Figures 8+9) for a first version of a *Degrowth Timeline* are starting point for work on this topic what will capture major ideas, actors and events. Ultimately I will attempt to reveal how the degrowth discourse challenges assumptions of economic models that fail to take their context (i.e. ecosystems) into account. The work engages with alternative economic models by mapping debates in this highly contested field. Since representing an overview of such a complex and contested field requires extensive understanding of the field itself, the process of developing new discourse maps is time intensive and slow. This is still unfunded research and it only in its initial stages.

Figure 12: Author co-citation network – 2008 to 2016 (top 1% of co-citations)
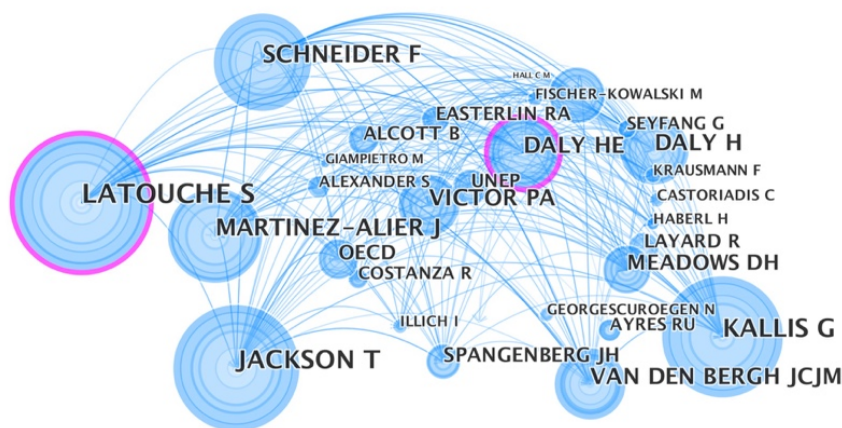
Figure 7. James Vandeventer's "Conceptualising the Degrowth Niche: An interdisciplinary study using bibliometrics and the multi-level perspective framework to explore the degrowth field" (2016).

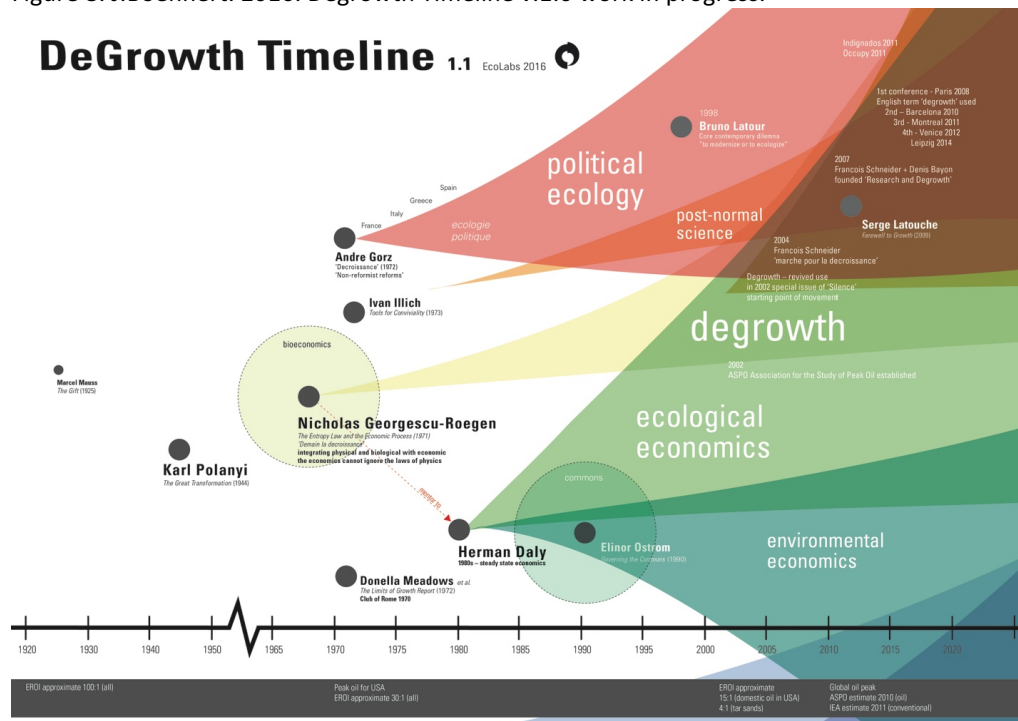Figure 8. J.Boehnert. 2016. Degrowth Timeline v.1.0 work in progress.

Figure 9. J.Boehnert. 2016. Degrowth Timeline v.1.1. work in progress.

Reflections

Discourse mapping is an interpretative knowledge visualization method that can capture nuances and meaning in complex political debates by revealing relationships and displaying changes over time. Knowledge visualization offers more integrated and actionable approach to information design than reductive approaches such as data visualization. With a critical theory of data visualization, enhanced with the concepts of datawash, dark data and digital positivism, it is obvious that integrated and politically informed visualisation approaches are necessary. The triangle models of hierarchies of understanding informs visualization theory. The work described in this paper contributes to the theory and practice of controversy mapping and knowledge visualization and cross-disciplinary social science collaborations in environmental communication. It also facilitates problems-solving on central dilemmas in the areas under investigation – as demonstrated with the examples from the *Mapping Climate Communication* project.

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