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Title: Understanding Internet-Mediated Research Networks. Can We Really Make Them Work?

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Introduction

In this paper we focus on how the Internet, or more precisely Internet-based information technologies, may be used by social scientists to support and enhance their work. In particular, we aim to understand why groups working over the Internet often fail to accomplish their goals. Based on this understanding we make some suggestions how collaboration can be improved.

The Internet can be seen as a very rich source of information that can be used for a great variety of purposes. Besides being a medium for *information gathering* and *publishing*, the Internet also provides an *infrastructure* for collaborative work. As an infrastructure, the Internet provides generic functionality (for example to facilitate work with email or videoconferencing), but its functionality can also be tailored to support specific professional communities. In this paper, we are concerned with one category of professional communities, namely research networks. In these networks professionals collaborate to produce joint artefacts, such as group reports or journal publications.

Although it is often assumed that Internet information tools greatly improve the productivity of research groups, in practice many applications are not very successful. The key objective of this paper therefore is to find possible explanations for problems experienced in Internet-mediated research collaboration, and propose potential solutions.

In this paper we approach networks as being constituted by dynamic processes, both as far as the understanding of behavioural issues of such a research network is concerned, as well as the development of a network information system. We do not concentrate on any particular configuration of the network at one point in time which we try to understand and design a system for. Instead, we perceive network evolution as a continuous process in which participants, roles, rules, responsibilities, activities etc. are open to ongoing change. Our focus of analysis is on the underlying processes which determine how a research network looks at one point in time.

We first explicate some characteristics of and our assumptions regarding research networks, and we briefly introduce a specification method (called RENISYS) currently being developed to design Internet-based research network information systems. We then present a theoretical perspective to analyse research networks as organisational processes, and end this paper with a discussion of the importance of enduring legitimacy of the network to make it work.

Internet-Mediated Research Networks

A research network mediated by the Internet is an example of a virtual professional community. It is a virtual community in the sense of its members sharing mental models and social norms (Rheingold, 1994). A research network is a professional community in the sense of its participants having a

common interest in the accomplishment of shared goals. To put it even more strongly: the goals of the research network are often its 'raison d'être', for example when a network is being established to organize a conference, or publish a journal. A very important characteristic of research networks is that their nature is egalitarian and participation is voluntary. This implies that the socio-technical context of the network cannot be imposed, but needs to be based on consensual agreement which unites the community.

Internet-mediated research networks are typically supported in their information and communication needs by sets of commonly available information tools, such as web tools and mailing lists. However, for collaborative activities to be optimally facilitated, integrated network information systems need to be constructed out of these separate tools. The network participants should play an active role in the analysis and design of these systems. This user-driven system specification process can be characterized as being both evolutionary and incorporating multiple perspectives (De Moor, 1997). Research network information systems typically start as very small constructions, aimed at supporting only a few participants in a particular activity, and slowly evolving into more complex systems. Furthermore, their development needs to be very sensitive to the social norms that balance the often widely different interests and preferences of the network participants. These development principles are the foundation of the RENISYS (REsearch Network Information SYSTEM Specification) method and the accompanying Web-based specification tool which are currently being developed (De Moor, 1997). One of the main methodological assumptions is that user-driven co-evolution of requirement and tool specifications will lead to more successful network information systems. Furthermore, because a research community is a socio-technical network, norms are essential in guiding both operational and specification processes. Finally, the method should provide concrete support for the identification of these norms and their subsequent use in guiding focused specification discourse between network participants.

In RENISYS, the focus is on the link between the social and the technical part of the network information system: the objective of the method is to produce an 'orchestra of information tools' which is tuned to the authentic needs of the network. A case analyzed from this perspective was described in (De Moor and Van der Rijst, 1996). The 'B.C. Forests and Forestry Group' [1] consisting of people representing the whole range of stakeholders from environmentalists to forest industry, was originally supported by a simple mailing list to facilitate free discussion on deforestation issues. The group then adopted the goal of writing a structured group report on a specific issue. The process of selecting the report topic, still mediated by the mailing list, went smoothly, and the degree of participation was reasonable. However, the moment the topic had been decided upon, and the report authoring process was to commence, all mailing list activity came to a complete halt.

It has been suggested that a possible explanation for this breakdown of collaboration is that the gap between changed requirements (from relatively simple discussion and voting procedures to highly complex authoring tasks) and constant, simple mailing list functionality had become too large (De Moor and Van der Rijst, 1996). More advanced authoring functionality, such as Web-based discussion tools, might have prevented this breakdown. However, in the following sections we go beyond this socio-technical explanation and focus on the network as a social process which requires constant legitimating and involves rationales for collaboration, interests, power distribution etc.

Research Networks as Processes of Organising

The nature of research networks and the supportive technology as we have described above is not static but dynamic. In order to understand the dynamics of research networks we draw upon process approaches to organisation. Such approaches differ from static analyses in the sense that they are not so much concerned with states or outcomes, but with the underlying process that continuously generates those states (Cooper and Law 1995, March 1994). Whether those states are at any one time desired or successful is not the central concern of a process approach, but exploring the inner

workings of this process, which can both lead to successful or failing states of a research network, is.

Although we have confined ourselves to those networks that are focussed on a particular set of goals, the means and ways how to reach those goals may differ and change, as well as the number of participants, the roles they fulfil, their respective responsibilities, rules to which they adhere etc. When we view research networks from a process perspective attention is drawn to the ways in which tasks are being distributed, how responsibilities between the participants are constituted and rearranged, how the participants decide on the rules and procedures which they consider relevant for the operation of the network. We thus conceive of a research network as continuous and plural processes of organising (Law 1994), 'which can be thought of as a set of recipes for connecting episodes of social interaction in an orderly manner' (Weick 1979). These processes of organising thus happen continuously and -directly or indirectly- involve every participant, which makes a network more like an assemblage of socio-technical organisations (Cooper and Law 1995, Bijker 1995). Research networks, as processes of organising, are to be understood in terms of the mechanisms and interactions that ongoingly constitute them, instead of as static, rigid entities. Basically, processes of organising consist both of forces and mechanisms that lead to change and renewal, and forces and tendencies leading to stabilisation [2]. The continuous interaction of these two groups of forces momentarily result in an order which to a certain extent is able to deal with the complexities and ambiguities of the ever-changing environment. Such an order can either be informal, or formalized as in explicit structures or systems. Order, however, never has an absolute validity but continuously needs to be experienced as legitimate by participants. Lack of legitimacy generates resistance on the part of those participants who feel an order is imposed upon them, or domination by those who cling to the order (Linstead 1997, Brown 1995).

In egalitarian and dynamic research networks (as we have described in section 2) order never is absolutely certain but always prone to change. The existence of an order thus cannot be an end in itself, but in networks that lack a hierarchical power structure the focus should be on the continuous process of generating (or specifying) a legitimate order. Legitimacy of an order thus is essential to understand whether and why a network is successful or not. It shifts the focus from 'the one right form' of order to the process of securing the legitimacy of order, whatever the order may be.

Legitimization and Consensus

Based on the perspective we have outlined in the previous sections, a research network information system should actively support the dynamic process of ordering so that a legitimate order can continuously be constituted. Lyytinen and Hirschheim (1988) have described this type of information systems as to 'help with the institutionalization of an ideal speech system which in turn validates a consensus about system objectives and modes of design and implementation'. Legitimacy, in this view, is connected to consensus which needs to be achieved and maintained over time. Although the concept of consensus seems clear, the term is controversial in its usage (Hård 1993, Winner 1993). Some interpret consensus as involving 'shared meaning' that human beings attach to certain events or artifacts (although meaning is inherently subjective), and the absence of conflict and difference (Hård 1993, Bijker 1995). In this paper we use the concept of consensus in the wider sense of agreement between network participants (regardless whether it is a compromise, full agreement or otherwise) which is the result of communication processes that have not been manipulated in any way. Such forms of consensus (Habermas 1984, Bijker 1995) however is not only to be established once (e.g. at the beginning of a development project as in traditional information systems development) but continuously as a process of 'consensual validation' (Weick 1979) which refers to 'the things people agree upon because their common sensual apparatus and deeply common interpersonal experiences make them seem objectively so'.

To enable consensual validation in the process of legitimating an evolving order, a research network information system should in principle be *transparent* to all participants and all participants should in

principle have the ability to *influence* the network, that is to engage in the process of organising. Participants in research networks need to see their interests served by (their participation in) the network, otherwise they will stop participating or frustrate the network (e.g. by forcing it to do something, or by overstressing the participant's own interests or goals). However, this does not mean that every participant **always** needs to be informed of **everything**, but rather that the *possibility* unquestionably exists that every participant can be informed about any decision or activity in the network, if so desired.

Transparency, then, means that the current state of the network should be recorded including the historical decision moments and reasons which have shaped the network so far. This state is to be seen as the things (e.g. the stabilities and the changes) people have agreed upon, like the minutes of a meeting. These should be available to every participant without some actor regulating the availability or distribution but the participant herself. Of course, exceptions to this general rule of openness are conceivable (e.g. if personal or professional privacy is at stake), but such non-transparency should be thoroughly motivated in explicit specification discourse.

Transparency, as mentioned above, has to do with the accessibility of network information. As far as influence of network participants on network decision making and development is concerned, it would not be wise to involve **everyone** in **all** changes, among other things to prevent the network from overburdening. A more practical solution is that each individual change only involves those participants to whom a particular change has relevance.

Each change is associated with what we will call the 'context of change', in which each element of the network affected by that change is included. For certain (groups of) changes the network may decide to transfer the final responsibility to an actor, as in the case of a journal editor having the authority to either accept or reject articles. However, in principle each participant is responsible for being informed about or being involved in a change, although an actor with final responsibility may have to take the final decisions. This final authority never is unquestionable though, because each participant has the possibility of influencing the responsibility and power structures.

Closely connected to the ability (or inability) to influence the order of the network is the notion of power. Power as a form of unwanted domination of one or a few participants does not comply with the principles outlined in this paper, and would evoke resistance (Linstead 1997, Brown 1995) on the part of other participants. On the other hand, legitimate power is a prerequisite for action (Leflaive 1996) and thus is an inherent aspect of functioning research networks. In accordance with our argument so far, the basis of power always should be relative, i.e. open to be questioned and changed. The authority of an actor is therefore never absolute or self-evident but should be based on consensual validation. Thus, every participant who wants to question authority should be able to initiate a group discourse.

Understanding human behaviour may help in the construction of better information tools by teaching us that the 'working' of a technology is dependent on a very complex, dynamic and ambiguous social context. A working technology, therefore, always is something to be explained as opposed to something self-evident (Pinch and Bijker 1987). In this paper we have tried to understand research networks and we suggested the process of legitimating is a key necessary condition for making such networks work. Whether or not research networks really work is a result of a multitude of factors at play. A participant may follow his or her own interests and thereby damage the network, power struggles may prohibit open discussion, other relationships (hierarchy, friends, boss-employer etc.) may dominate the behaviour of network participants and so on. We therefore believe that further research in this area could prove to be very helpful in improving Internet-mediated research collaboration.

Footnotes

[1] Information on the B.C. Forests and Forestry Group can be found at:
<http://infolabwww.kub.nl/grnsd/bcfor/>

[2] In this paper we lack the space to discuss these mechanisms, but for a more extensive analysis see March (1991) and van der Blonk (forthcoming).

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Heico is interested in the social consequences of information technologies and how technologies are shaped and appropriated by human actors. He holds a bachelor's degree in information systems design, and a masters degree in organisational sociology. Currently (1998) he is finishing his phd dissertation on processes of change in information systems in large, dynamic organisations. More information can be found at Heico's homepage: <http://www.econ.vu.nl/~heico>.

Aldo de Moor (assistant researcher)

Aldo's research interests focus on how such virtual professional communities as research networks can be more actively involved in the ongoing development of their own information systems. Aldo holds a masters in Information Management. He is currently finishing his Ph.D. on the development of a user-driven specification method for network information systems. A list of publications and other links to Aldo's work can be found at <http://infolab.kub.nl/people/ademoor/>



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