Constructing Common Information Spaces

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This paper investigates an important, yet under-researched topic in CSCW, namely shared, or common, information spaces. We provide some background to work in the area, and then proceed to examine features of such spaces. The work involved in both putting information in common, and in interpreting it, has often not been sufficiently recognized. Through a number of situations we discuss the influence of particular conditions, and the translations required. We show how, in various ways, it requires added work to place items in common, and open up the question of how this might affect use of the WWW, often seen as the ultimate common information space.

1. Introduction

One of the distinguishing features of the CSCW field is its persistent attempts to come to terms with the sociality of work, with a view to better understanding the nature of cooperative work as a basis for designing genuinely "supportive" computer-based information systems. In its attempts to achieve this goal, the field has embraced a variety of disciplines, conceptual frameworks and methodologies. Whilst not all members of the CSCW community themselves share perspectives or approaches, the field as a whole has been shaped by a number of core ideas, including that of Suchman on "situated action", of Winograd and Flores on "action workflows", and latterly of Schmidt on "coordination mechanisms".

The CSCW field has managed to contribute to a more *nuanced* understanding on the part of information systems practitioners about the complexities of human communication, cooperation and collaboration in everyday work settings through numerous "workplace studies" that have appeared in the CSCW literature (Anderson, Button, & Sharrock, 1993, Heath & Luff, 1992; Egger & Wagner, 1993, Button, 1993). While these studies demonstrate the richness of human cooperative activities in various work settings, their lessons for systems (re-)design are not as obvious. For one thing, many of these excellent studies focus on very specialised work coordination centres and it is not always immediately apparent as to which aspects of the situations depicted have general relevance to more mundane work settings where technologies are being employed. We are still learning how our designs can be informed by these studies and the issues they raise. One important concept that has been discussed in CSCW and shown to have importance in many studies, is the need for some form of shared information space within which people can cooperate. Exactly what constitutes this space is often left underspecified, yet in most references to the term, the realisation that this concept goes well beyond the simple concatenation of objects or events in some form of common database is acknowledged.

In this paper, we endeavour to analyse the concept of *common information space* (CIS) and show, through examples, some of the issues involved in their construction and use in real-world work settings. The structure of the paper is as follows: In Section 2 we provide an account of what we believe to be substantial earlier discussions on this theme, and also connect these discussions to a number of other important topics that have surfaced amongst researchers studying the boundaries between people, technology and work settings. In an extended Section 3 we explore different features of information spaces, illustrated with examples, which align some of the heretofore apparently contradictory findings concerning the nature of shared information spaces by demonstrating the dialectical nature of the spaces, before concluding the paper.

2. Background

Within the field of CSCW the necessity for developing some form of "shared" information space within which cooperating actors can perform their individual and collaborative activities has often been recognized as an important feature of a set of cooperative work situations. Exactly what constitutes such a space, and to what extent it refers to information, events, objects that are tangible, external, "out there", that can be described extensively, or whether the "space" being described necessarily involves an interpretative component on the part of the human actors who use this space is often not clear. Yet such a disambiguation would appear to be necessary if we are to be able to actively use such a concept in design. Perhaps one of the most detailed attempts to explicate the nature of this concept appears in

Schmidt & Bannon (1992), following on from their earlier discussion of "shared information spaces"[1] in Bannon & Schmidt (1989, 1991), where they discuss common information spaces as an alternative mechanism to procedural or workflow-type arrangements that could support cooperative work:

> .. the construction and management of what we term a "common information space" has, in our view, been somewhat neglected, despite its critical importance for the accomplishment of many distributed work activities. Here the focus is on how people in a distributed setting can work cooperatively in a common information space - i.e. by maintaining a central archive of organizational information with some level of 'shared' agreement as to the meaning of this information (locally constructed), despite the marked differences concerning the origins and context of these information items. The space is constituted and maintained by different actors employing different conceptualizations and multiple decision making strategies, supported by technology. Schmidt & Bannon (1992)

Schmidt & Bannon note that this space does not simply consist of objects, events, e.g. in a shared database, but also crucially involves the joint interpretation of these objects and events by the actors involved :

> Cooperative work is not facilitated simply by the provision of a shared database, but requires the active construction by the participants of a common information space where the meanings of the shared objects are debated and resolved, at least locally and temporarily. Objects must thus be interpreted and assigned meaning, meanings that are achieved by specific actors on specific occasions of use. Schmidt & Bannon (1992)

They discuss in more detail the issues surrounding the interpretation work that is required by the actors in order to construct common meanings. They indicate possible problems that may occur in the subsequent interpretation of information by others where the origins of the information, in terms of the person or system that constructed it, or aspects of the context within which the information was produced, may not be available to other actors in the space. In such situations, the intended meaning of the information may not be apparent to the new user, as the information objects typically do not record the originator of the information, nor the context of its creation. Examples of situations where this lack of contextual information can be important are also given. Crucially, the paper also distinguishes a variety of work settings, and shows how the work involved to make these information spaces cohere for the actors involved can be radically different in different settings. We will return to this point later in the paper.

The problems encountered when different groups of people are involved in the production and maintenance of an information space extending over time and space have surfaced in a number of quite disparate studies concerning the relation between people and technology, many of which have not been conducted by people in the CSCW field. Within the field of social studies of science and technology, the

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[1] While originally, in Bannon & Schmidt 1991, we referred to "shared information spaces", we subsequently shifted to talking of "common" spaces as it lessened the connotations associated with the word "sharing" - and indicates the transient and instrumental aspects of people having information "in common".

problems of “alignment” of human and technical actors has been noted, and the way artefacts both shape and are shaped by the actor networks within which they participate (Callon, 1991).[2] The work of Leigh Star and others on the concept of “boundary objects”, and that of Latour and colleagues on the creation of “immutable mobiles”, both can be viewed as being concerned with how communities develop means for sharing items in a common information space. For example, based on a study of a zoological museum, its creation, use and representations, Star & Griesemer (1989) introduce the concept of boundary objects characterising common intellectual tools, which playl the role of containers and carriers:

> ...both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual site-use. Like a blackboard, a boundary object 'sits in the middle' of a group of actors with divergent viewpoints (Star & Griesemer, 1989, p. 46).

The ordering and registration of the animals in the museum is one example of a boundary object, a map is another. They are both there to be used by all users of the museum, though these users use the boundary objects in very different ways. As we shall see, discussions of boundary objects can be a vehicle for further studies of common information spaces across organizational boundaries.

Understanding how people work together in networked communities is another area of investigation that has relevance for our discussions here. The concept of “community of practice” developed by Lave & Wenger (1991) to indicate the learning and working environment(s) in which most people work has important implications for the kinds of shared spaces that we might wish to develop for particular purposes. Whether we are moving information within or between communities of practice becomes of central concern. Within the CSCW field, Robinson and Bannon (1991) explore some of the difficulties that can occur in sharing representations across different communities. Different groups, professions, and subcultures embody different perspectives. They communicate in different “jargon”. Much of this cannot be translated in a satisfactory way into terms used by other groups, since it reflects a different way of acting in the world (a different ontology and epistemology). They discuss how what they call different “semantic communities” (a concept akin to “community of practice”) will necessarily interpret representations in different ways, again potentially leading to serious problems caused by the loss of the interpretative context which goes with the representation or information[3]. This can lead to a phenomenon they term

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[2] The validity of the actor-network framework is not our concern here, simply to note that some of the work done under its rubric is of relevance to our current concerns about the development of common information spaces.

[3] One of the points of the present paper is, however, that the network of semantic communities is in many situations rather fine-grained, and a consequence of a variety of organizational and legal conditions.

"ontological drift", as the intended meaning becomes distorted as the representation object moves across semantic boundaries.

> Definitions may be quite adequate in their own communities, but do not translate or transfer between communities. The question is not one of adequate definitions in each domain, but of how these definitions might relate to each other. The question is not how to verify propositions. The essential problem is how to *integrate activities that are taking place on different ontological foundations*. The question is one of competence rather than truth. Robinson and Bannon (1991)

Whilst the Robinson and Bannon paper discusses these issues in the context of systems development methodologies and practices, the problems noted pervade almost any distributed cooperative work setting where there is a requirement for the maintenance of some shared understanding of objects, events, information etc. within an information space peopled by actors from different communities of practice. Bücher et al. (in preparation), propose that whereas Lave and Wenger's concept of "community of practice" is useful in studying what in Bannon and Robinson's terms is called a semantic community, it may be helpful to seek inspiration from actor-network theory and Star's "boundary objects" concept when investigating situations where objects move across semantic boundaries. This is due to the fact that both the active construction by the participants of a common information space - where the meanings of the shared objects are debated and resolved - and boundary crossing of objects between semantic communities, often are very closely interlinked. As Bücher, Gill, Mogensen and Shapiro explain:

> We are therefore drawn to some parallels with the application of 'actor-network theory' to the study of science (..) There too, there is a concern with the way in which the resources of a process - people, machines, materials are mobilized; and with the way that the outcomes are sometimes simplified as 'punctuations' which realise a particular form of summation of a network's activity (...). This can often be as texts or what Latour (..) terms 'immutable mobiles' - artefacts which hold stable the intractable and heterogenous materials from which they were composed, and which can be conveyed, collated, compared. We consider that the intimate engagement of an ongoing work process is better understood as a community of practice, whereas an actor-network approach can be helpful in understanding the hand-offs and translations which are also a natural feature of the work. Crudely a punctuation can be a point of closure for a situated practice - albeit sometimes a local and temporary one, requiring maintenance and repair.

It is this tension between the need for openness and malleability of information on the one hand, and, on the other, the need for some form of closure, to allow for forms of translation and portability between communities, that we believe characterises the nature of common information spaces, and leads to difficulties in their characterisation. CISs are both open and closed - in a word, they have a dialectical nature. As an example, Bødker (in preparation a) discusses the development of "portable contexts" of representations for systems development (Brown & Duguid, 1994). The context of use is continuously changing, in a dialectical relationship with the practice emerging in the borderland between various

communities of practice. These issues of translation, closure, contexts, portability, etc. relate directly to aspects of Latour's (1987,1990) analyses concerning the construction of "immutable mobiles". Again, we are dealing with the problem of maintaining and preserving some shared interpretation or representation, artefact, across divides of space, time and culture. The work of Clement and Wagner (1995) on fragmentation and regionalisation of spaces and their implications for the possibilities of shared communication is also quite pertinent. While some of this discussion may seem overly esoteric and, at first glance, of little relevance to ordinary CSCW system design, we hope to show through illustrative examples below how such ideas can assist us in understanding the problems and the successes in the construction of common information spaces.

3. Articulating dimensions of CISs

> *No representation ..... is either complete or permanent. Rather any description is a snapshot of historical processes in which differing viewpoints, local contingencies and multiple interests have been temporarily reconciled.*
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> Gerson and Star (1986)

In this paper we describe how differing viewpoints, local contingencies and multiple interests are temporarily reconciled in the actual construction of a CIS; how information items may be supplied with some kind of portable context; how local contexts are re-established based on the unpacking of the information from other contexts of use; and how, as a consequence, information items can maintain their open and malleable character in local contexts. We propose that most common information spaces have two aspects: perceived as the working material of a community of practice, the CIS is open, malleable and interpretable, and a number of concerns, as exemplified by the studies on centres of coordination, are highly relevant. At the same time, creating closures of various kinds - punctuations - is an equally valid perspective, suggesting a perspective on the common information space as boundary object (Star), border resource (Brown & Duguid), or immutable mobile (Latour). It is the interplay between these two perspectives that can help illuminate the nature of common information spaces.

We find further inspiration from Giddens (1990) who discusses organizations which have been delegated a certain area of societal competence which is not a part of the everyday competence of the rest of us. We *trust* these organizations if we get what appears to be reasonable treatment from them. For such an organization to create trust it is extremely important not to reveal the complexity and ambiguity of phenomena/decisions "frontstage" -i.e. their operations and activities are accessible and visible to users. From the viewpoint of the organization, it is important that procedures are not only carried out correctly, but are clearly seen to be so, from the outside. This frontstage side of organizations in many cases puts an emphasis on

closures and immutability whereas “backstage” the perspective of the CIS as open and malleable often makes more sense. In what follows we will use a number of examples to illustrate how common information spaces are constituted rather differently in different organizations. In many cases, this is indeed a result of a trade-off between the concerns for openness and malleability on the one hand and for closure on the other. We will specifically look at the work required both to leave an information space malleable and open, and to create these necessary closures so as to transform the information into something that is immutable and ready to “travel” across boundaries of communities of practice.

3.1. Creating a CIS - within a community of practice

In a number of work situations, the nature of the work is such that errors of interpretation cannot be allowed due to the safety-critical nature of the operation - e.g. control of power stations, flight of aircraft etc. Here work arrangements have evolved to produce complex centres of coordination (e.g. Suchman, 1993, Goodwin & Goodwin, in press) where several people and artefacts are physically co-located and jointly handle the large number of complex interweaved tasks involved. In the airline operations room described by Goodwin & Goodwin, Suchman and others the CIS is constituted by the representations of objects and events depicted on screens, charts, etc., spoken out loud in the room, etc. Many of the objects referred to are “out there” as planes, gates and such to be inspected through various more or less structured means. This is combined with complex sheets and other more specialized coordination devices. The common information space is shaped by reading out loud, by shared access to gate monitors etc. Goodwin & Goodwin (in press) put much emphasis on how this common information space makes it possible to constitute rather different readings based on the purpose of the activity, and that the openness of the access is important. In this example the common information space is open and situated, with the participants being able to make interpretations based on their shared physical context. Here, there is a need for as rich a common information space as possible, as the ever changing conditions may require modifications to established procedures, and any such changes require coordination across the set of activities being performed. In such situations, we find numerous examples of complex human coordination patterns, involving “looking over each other’s shoulder”, peripheral awareness, joint monitoring of status screens, broadcast announcements, etc., all intended to ensure that the group as a whole is aware of the current situation and monitoring the unfolding events. In such a situation, members of the team do not have the time to package their information in particular ways, but have to assume that others can interpret events correctly due to the massively shared context that exists in this work setting. To “become a member” thus involves being able to recognize the significance of reports, events, information based on their order of production in

the sequence of tasks and the setting of their production, without excessive contextual elaboration in the production of the material itself.

3.2 Constructing CISs when cooperating at "arm's length"

However, most work settings do not require this level of cooperation. In many situations, there is a well-specified division of labour, and regulated procedures to package information and control its movement to selected people in the line. Such a work arrangement reduces the need for an extended common information space, as workers are only required to handle limited amounts of information, and within well-defined procedures, so the problems of ontological drift are minimized, even without direct access to the originator of the information or the full context of its production. Such organizational arrangements characterize, in Weberian terms, a bureaucracy, where rules and regulations govern behaviour, and identities of individuals become unnecessary and even inappropriate. In situations where "standard operating procedures" can be devised and followed, we have a situation where the openness and malleability of the representations have been minimised, and thus the information can pass to other groups working within the bureaucracy with a minimum of interpretative work (though work is still required, inevitably). The issue involved in the construction of common information spaces, whilst existing across all cooperative work arrangements, become crucial in situations where people are cooperating at "arm's length" (Schmidt & Bannon, 1992) and do not have the ability to clarify interpretations of information, as might be possible say in collaborative work situations such as air traffic control rooms or other coordination centres where people are co-located. As more and more work becomes distributed in time and space, and as the demands of the work increasingly require flexibility in responses, where traditional bureaucratic procedures and workflow-type systems are found wanting, there is increasing need to support common information spaces. A key concern here is with the active nature of the understanding process on the part of the participants. Without an understanding of the different contexts in which information is produced and potentially the different concerns of the originator, the actor is liable to make incorrect inferences as to the meaning of the "shared" information. But the important point is to realize that one cannot just produce a common information space, that it does not automatically appear as the result of developing a common dictionary of terms and objects, as the meanings of these terms and objects must still be determined locally and temporally. The common information space is negotiated and established by the actors involved. There is effort expended on the part of people who put information into the CIS, in terms of how they package the information or event so that it can be successfully be decoded by other, perhaps anonymous people in some future use situation. There is also effort expended on the part of those people who lookup information in this common information space and attempt to make sense of what

they find, when they may lack knowledge of the context in which the information was produced.

3.3 CISs - who produce the information and how do we trust them?

If one goes to the railway station and looks at the time table, one hardly cares who produced the time table. What matters is if the organization as such cannot be held accountable for the timetable, i.e. if there is no train, no announcement of its absence, etc. The trust, or accountability is more in the role (i.e. that somebody, and most likely more than one person, who knows how to make time tables and has responsibility for this task, actually does it). In the library, one doesn't hold an individual accountable for the fact that there is an error in the registration of a book (as a matter of fact the whole procedure in a library is set up so that there is no such single person). If a tax payer receives a letter from the tax office, it is not immediately important to him or her who sent it - because the message from the authority seems more important. For such an organization to create trust it is extremely important not to reveal the complexity and ambiguity of phenomena/decisions visible to users. Procedures need to be seen as carried out correctly from the outside. This can mean that much of the backstage activities required to produce the seeming orderly handling of events do not show up in the external manifestation of the procedure. In the context of common information spaces, issues of how closures are created become important - what is inscribed in the record and what is left out. From the perspective of providing as rich a context for interpretation of the information as possible, logic would indicate that working notes, comments etc. should be available on the system so that future users of the information could, if necessary try to re-construct the rationale. But as all of the information in these systems could legally be require to be produced in certain cases, in order to ensure proper procedures and provide a coherent frontstage view, it may be “logical” to refuse to allow these kinds of working notes to be inscribed in the record.

Example: At the local branch of the Danish National Labour Inspection Service (AT), a centralized computer system (VIRK) is applied to record the interaction of AT with companies in the geographical area covered by the local branch (see Bødker 1993). Visits to work sites as well as correspondence with companies are recorded, and various materials can be extracted, ranging from lists of specific types of companies within a geographical zone to lists of which recommendations and demands the AT has sent to a specific company. The system is also used to provide statistics for the head office in Copenhagen. These figures (numbers of visits, demands, etc.) is the way in which central management has access to the doings of the branch office. Furthermore there are limited possibilities for maintaining work material for the handling of a particular case. The files of interaction constitutes the organizational record of past cases and procedures, the retrieval of which is supported by VIRK. Due to Danish legislation, citizens have

access to all information kept in electronic files by public authorities. This makes VIRK interesting in that it is actually primarily meant to support internal division and delegation of work, i.e. back-stage activity. However, because of the potential public access it is only possible to add things to the files that the labour inspectorate are willing to let the "customers" see. This makes internal notes and remarks highly problematic, and filing in VIRK can be seen as an unceasing transformation of material from back-stage to front-stage, thus leaving a big hole as regards the maintenance of working material. Internal notes etc. are simply not able to be kept together with the case material. As described in Bødker (1993) the inspectors want to keep such notes and leave traces for later case work, but that is not possible in the current situation[4].

While bureaucracies may value anonymity for certain purposes, there are many situations where the interpretation of information in a CIS requires knowledge of the identity of the originator of the information. Due to the fact that people employ different problem-solving and decision-making strategies, people may need to allow for the different strategies used by people who are populating the information space. For example, as observed by Cicourel (1990) in medical practice, "the source of a medical opinion remains a powerful determinant of its influence." That is, "physicians typically assess the adequacy of medical information on the basis of the perceived credibility of the source, whether the source is the patient or another physician." Thus "advice from physicians who are perceived as 'good doctors' is highly valued, whereas advice from sources perceived as less credible may be discounted." As Schmidt and Bannon (1992) have noted, in cooperative work settings involving discretionary decision making, people may need to be able to mutually critique the decisions of their colleagues, thus requiring access to the identity of the originator of a given unit of information. So while in many situations organizations can efface the identity of the worker involved in specific tasks, there are many occasions of use of information where this anonymity places severe restrictions on the person who perhaps at some later date wishes to understand the meaning of a particular decision or directive.

3.4 Mediating CISs - evolving roles of human mediators

One important mechanism by which common information spaces can be supported is through the use of human mediators that help both producers and consumers to package and subsequently interpret information in the CIS. We have already noted some of the effort that is involved both for those contributing to the CIS, in terms of how they package their material so that it may be of use in some future, unknown context, and also the work that must be done by those accessing the CIS, in trying to interpret the meaning of certain information, texts, from some previous

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4 Later work, in this case may involve some other inspector or the individual entering the information; perhaps several years later.

situation where not all the “relevant” cues are available. To assist in the process of developing a CIS, we can find evidence of the emergence of a variety of human mediators whose purpose is to assist those producing items for the CIS, and also in packaging relevant information for those who might wish to use the information. What is interesting is that these new roles as mediators emerge because of the introduction of a common technical environment and develop hand in hand with this.

Example: A software company that develops computer support for, and planning of, public transportation (see Bødker, in preparation b, and 1996). The company supports a number of object-oriented projects, with a technical platform that is based on Windows, C++ and Oracle. One of the major goals of the company has been to increase reuse of code and, the company has established a core library of 50-60 classes that are applied by all projects. This library is maintained by one person, the platform co-ordinator, who offers his service to the projects through active participation, in particular in the design of programs. The platform coordinator knows the platform well enough to be able to produce, for each project, a “parts list” of objects and classes that the project will need from the shared library. It is up to the platform co-ordinator to decide what is put in the shared classes. He does this through his close contacts with the projects, and at times upon direct requests. Bødker (1996) has illustrated how the role of platform coordinator is new and a result of the wish to share pieces of code, one of the much praised advantages of object-oriented technology. Based on this software development case and experience of another case of shared standards in a office environment (Trigg & Bødker, 1994) we have noted how a variety of structures or mechanisms for sharing or distribution of the platform components are emerging, and how these are partly dependent on the skills of the platform coordinators, and partly on other conditions in the use/development environment. In both cases the efficiency and quality of sharing goes hand in hand with the additional work performed by the platform co-ordinators.

3.5. A Look at CISs on the WWW

The kinds of issues that we have been addressing take on new twists as we observe the ways in which information is produced and consumed on the World Wide Web. As an example, we will refer to a Danish case that we have been investigating. PlanteInfo is a Web site funded by the Danish Farmers' Associations containing a variety of sources of information about farming. The actual PlanteInfo web pages are provided by the Danish Institute of Plant and Soil Science. Through PlanteInfo the farmers and farming advisors are able to get daily updated information on the spreading of diseases, and access to data bases of agricultural providers, soil temperatures, and to various computer programs. Some of the pages are maintained by the Danish Agricultural Advisory Service. Other pages are maintained by the Meteorological office, pesticide manufacturers, and companies

buying and selling fertilisers, etc. So here we have a number of different information providers, with different goals and objectives, providing information to a Web site that is used by a large number of people connected with the agricultural trade. Given this heterogeneity of user groups and possible uses, it is not surprising that a number of problems about the nature of the information space created by PlanteInfo have cropped up. The reliability of the information is vital to the farmer, raising a number of problems, the first one being the reliability of semi-automated updates based on figures entered across the country. Secondly, the farmers can make good use of information from the various commercial suppliers. The question is, however, to what extent this information is to be trusted? Both in terms of whether a web page can be guaranteed to be found, and in terms of substance: the companies of course promote their own products as remedies for particular pests. Provided that the farmer can see where the information comes from (that he is now on a web-page belonging to a commercial company) he is likely to understand this phenomenon, but how reliable are the offered calculations of doses etc.?. While the Danish Institute of Plant and Soil Science want to link to such information, they have no way of verifying it.

The situation is somewhat different with such agencies as the Meteorological office in that, in Denmark, they have no immediate commercial interest in the information they are providing. Also it is a State run agency who have their own official Web-pages and services. Independently, there is the problem that if the Danish Institute of Plant and Soil Science does not want to process and verify all the information to be put on their web pages then they need to trust the information that they link to and the institutions or individuals who provide this information. And an important topic is how to create such trust, as it is obviously the case that there are many unreliable web pages “out there”. A variety of potential contracts and rules for the maintenance of the pages that the Institute is connected to could be considered. The role of the Institute is in itself an instance rather similar to the platform coordinator. However, in order to do anything with the problem of validity of the information submitted by other organizations, there seems to be yet another level of articulation work needed, that of networking between platform coordinators in cases where information is not warranted by the organization, or by trusted individuals.

One perspective that has had relatively little relevance for the discussion of this case so far is that of an open and malleable common information space. In some ways this is because there is very little relevance for such a perspective, given the large number of different kinds of users, and the inherently open “substrate” of the common information space, the WWW. The information that is provided must be already packaged to an extent, thus making it more mobile while at the same time less flexible in its possible interpretations. Thus in terms of our discussions of CISs, the Web may paradoxically be one of the most open - in the sense of accessible - electronic spaces that exists, while at the same time be one of the most closed - in the sense that due to the heterogeneity of users and possible use

situations, the possible interpretations of the information that is presented is impossible to know. Thus, once one moves beyond very factual information it becomes very difficult to control possible interpretations of the material. One may see the WWW as a kind of substrate for common information spaces e.g. for farming counselling, and those developing such common information spaces may wish and need to set up their own rules and deal with them. How such networking will eventually evolve remains speculation. Hopefully, however, it is possible to learn from the ways in which organizations have managed these problems under more conventional technology regimes, though we are convinced that some of the solutions need to take new forms.

4 Concluding Remarks: The dialectical nature of CISs

In this paper we have discussed how there is more to CISs than leaving a personal information space open or accessible to others. This applies at a personal level where we have discussed placing in common objects in a common object-oriented platform, and in highly collaborative settings such as highly open and shared centres of coordination, where the "cost" is in terms of ongoing, mutual monitoring of information and activities and a high degree of common work patterns. At higher, organizational levels we have seen what it takes to place in common organizational files across organizational boundaries, and how organizations need to deal with trust and accountability. Furthermore, we hope to have illustrated that to place in common means an effort both at the point of closure where an information item is packaged to be placed in common (where the common information is produced) and in receiving, opening and interpreting this information, placing, or re-placing it in a local context.

Common information spaces come in many forms, and this paper has illustrated their dialectical nature, emphasizing on the one hand the open and malleable role of a CIS within a community of practice, and, on the other, the role of CISs as boundary objects, packaged and being turned into immutables to allow for sharing across contexts and communities of practice. We have discussed how the tension between frontstage and backstage needs is an important force in shaping the CIS. Common information spaces are in some cases constituted for collaborators that are co-present in time and space, whereas in other situations they are constituted across time and space boundaries, and the mechanisms used to support holding in common the information varies accordingly. This type of analysis may be elaborated on a variety of levels, emphasizing the variety of functions of e.g. an entry in the file of a public office: the entry is in itself situated in the community of practice of the office. It is often dealt with, and packaged by one person to be sent on to the next etc. At the same time, a similar analysis applies on the file as such - inside the organization, and as we have seen with VIRK, in relation to its surroundings.

As Bowker & Star (1994) discuss concerning the international classification of diseases, fairly large, and in some senses rigidly defined CISs benefit from an ongoing concern over the definition of the rules concerning how information is submitted. A common information space is not just a repository of information constituted once and for all, which raises interesting concerns for design: Designing a common information space entails concern for possibilities of sharing, looking over shoulders, etc. on the one hand; for the rules of submission of information on the other; and on top of this for the possible roles of human mediators; frontstage/backstage concerns, and potential reworking of rules. With the WWW example we have illustrated that just because the WWW provide a better substrate for a CIS, these problems still exist, and some are accentuated even more because of the vastly heterogeneous user base for Web applications.

In sum, it requires added work to place items in common, work that would not be required if it was not for the CIS. It poses interesting challenges to CSCW research focussing on reducing the complexity of articulation work, when faced with CISs that introduce new kinds of articulation work that would not have been there without the CIS. As Clement and Wagner (1995) so aptly note, in their concluding remark, with which we heartily concur: "...CSCW design should take account of the regionalised character of "real world" communications and by offering tools for creating a corresponding multiplicity of communication spaces, provide the technical basis for the necessary negotiations between the actors involved".

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