Constructing the 'Dossier Représentatif'

Computer-Based Information-Sharing in French Hospitals

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Abstract. This paper analyzes the complex nature of collaboration in hospitals. Information-sharing under different technological regimes and work organizations is examined with special attention to the role of different types of screen-based records. The need for supporting local practices, professional distance and the different world views of the medical and nursing staff and administrators is stressed. Four meanings of information sharing based on the idea of a 'dossier réprésentatif' are explored: (i) a core document of basic patient-related data which is shared by all organizational units and professsions; (ii) using the (real time) transfer of data across a distributed environment to strengthen the opportunity for dialogue; (iii) computer support for 'browsing' through a variety of folders that embed different practices; (iv) a unified dossier shared by a bounded collaborative ensemble.

Introduction

Practices of information-gathering and information-sharing in a hospital reflect a complex social field of professional relationships. This paper examines the impact of information systems technology on the collaborative nature of hospital work.[1] It uses case study material from three French hospitals (Schneider and Wagner 1992).

Much work within the CSCW field has focused on 'small cases' which allow to study in-depth a community of practice and how the involved actors manage heterogeneity and complexity. Our study of hospital information systems extends this perspective by looking also at the interrelations between local communities and the larger organization in which these are embedded. By presenting cases of technologically mediated collaborative activity in a real world organizational environment, our analysis calls attention to the political nature of information-sharing. The 'situated nature' of human action is seen as being enmeshed with issues such as management control and professional boundaries. The idea of a 'dossier réprésentatif' which links and interconnects different communities within a hospital exemplifies our perspective. It makes it necessary to look simultaneously at local communities, a ward, nurses, a medical speciality – and at their interfaces with other organizational units. Our goal is

- to show the multiplicity of transactions in hospitals and the corresponding variety of documentation practices; and

• to identify boundaries between organizational units and professional groups that might be enriched and strengthened by information technology.

1. Changing occupational 'milieus': the role of information technology

The delivery of medical care depends on the collaborative effort of different groups of health personnel each representing specific substantive and social domains. Hospital work is intensely collaborative, although the knowledge that has to be pooled is distributed and the tasks to be performed are highly specialized and carried out in different parts of the organization.

BETWEEN HETEROGENEITY AND INTEGRATION

Hospitals host such diverse occupational groups as physicians, nurses, technicians, and administrators. These groups, through their professional training and socialization, develop their own thought worlds and form distinct occupational 'milieus'. Skills, tools, work styles, organizational forms, technical language, career patterns play a crucial role in the shaping of occupational identities. As a result of occupational differentiation, there is a diversity of 'cognitive maps' (Weick and Bougon 1986) to be found in a hospital, expressing hierarchies of knowledge, distinct view of a patient's trajectory though the hospital, and a plurality of approaches to patients' illness and healing process. This also results in organizational fragmentation, with physicians living in medical departments. In many cases these medical departments constitute a 'parallel' organization which is only loosely coupled with the 'rest' of the hospital.

Various schools of thought have grappled with the task of understanding the day-to-day functioning of collaboration under conditions of diversity, fragmentation and potential conflict: theories of organizational symbolism and distributed cognition, symbolic interactionism and ethnomethodology (with its constructionist approach to the 'reading' of cultures and practices). What is interesting in these theories is their focus on actors' interpretation systems as constructive elements of organizational reality. We borrow from these theories what seems helpful for understanding the diversity and incommensurability of perspectives on one hand, actors' ability to manage heterogeneity by sharing information, by communicating effectively and collaboratively producing products and services on the other hand.

Given the multiplicity of perspectives, Mary Douglas argues, it is far from evident that people be capable of producing collective goods. She points to the role of institutional belief systems: "Any institution then starts to control the memory of its members it causes them to forget experiences incompatible with its righteous image, and it brings to their minds events which sustain the view of

nature that is complementary to itself. It provides the categories of thought, sets the terms for self-knowledge, and fixes identities" (1986, 112). Mary Douglas draws attention to those elements of an organization's culture that provide stability – collective 'thought worlds'. These form the "deeply layered structures that recursively organize everyday life and practices" (Riley 1983, 417) and influence the production of meaning, the authorization of knowledge as well as the allocation of resources, and the legitimating of action.

While some scholars stress the stability creating elements of an organization's culture, Bühl (1986) suggests to base analyses of cultures (or thought worlds) on the distinction between a 'highly integrated core' and a zone of fluctuating, non-synchronized cultural elements. He views culture as 'fuzzy systems', characterized by high design and low control complexity. Whereas the 'core' consists of those base assumptions and fundamental beliefs that all members of an organization share to a certain extent and that are central to the organization's identity, the 'fluctuating zone' reflects the rich complexity of values, practices and styles that different subcultures develop when pursuing their own goals and strategies.

Theories of socially distributed cognition seek to identify the links between different systems of knowledge or thought worlds. In his analysis of medical decision making Cicourel stresses the importance of institutionalized settings. He describes how presumed competencies and entitlements frame distributed problem solving in local contexts such as a microbiology lab. In discussion of a patient: "The IDA (infectious disease attending) may provide a few initial remarks about the patient but the MR (medical resident) is expected to fill in many of the clinical details needed for clarifying the relationship between the patient's symptoms and laboratory findings" (1990: 238). Hospital work is largely carried out in local contexts – at the patient's bed, in the OP, an out-patients room – in which members of different occupations interact and pool their knowledge to solve a particular problem. Their voices are heard and assessed against the background of their status and reputation.

Among those elements of a hospital's culture that support the pooling of resources is the strong internal hierarchy of knowledge, with the physician's "ability to create 'objective' representations of a patient's mental and physical condition" (Cicourel 1990: 228). However, in a hospital knowledge is much more widely distributed than professional boundaries would suggest. Underneath a well-defined hierarchy and distinct specialities a sharing and overlapping of competencies and knowledge can be observed. Not only do e.g. interns rely heavily on nurses' judgement and wealth of practical experience. Nurses in general learn "to use subtle non-verbal and cryptic verbal cues to communicate recommendations, which in retrospect appear to have been initiated by the doctor" (Hughes 1988: 2). Hughes gives examples of nurses tacitly interfering when they felt that doctors' instructions were not in the best interests of patients. Similarly, radiology technicians operating ultrasound equipment or computerto-

mographs need to develop in-depth diagnostic knowledge to make a patient's problems visible. This knowledge is considered medical and therefore remains invisible in technicians' official job descriptions (Wagner 1991a). These findings suggest that hospital staff's 'reading' of different sources of information is shaped by a complex network of tacit cultural regularities.

One further step towards an understanding of how participants in a medical discourse (as representatives of occupations and their distinct thought worlds) manage multiplicity, is Star's concept of "boundary objects" (1989). She argues that in order to be able to share events actors need to create some common ground – data, material structures, organizational arrangements. To serve as common ground a boundary object needs to be sufficiently ambiguous for actors to fill in their specialized viewpoints. But at the same time is has to be durable to allow actors to develop conventional or routine ways of coping with ambiguity. Hospital staff's internalized images of model trajectories – these "visualize what might be termed an 'arc of work', that is, the overall work that needs to be done to control the illness course and get the patient into good enough shape to go home" (Strauss et al. 1985: 30) – might be read as examples of a boundary object. These trajectory schemes are simultaneously global and local, general and specialized. They provide the kind of common ground that helps different professional groups to solve problems under conditions of uncertainty and ambiguity (problematic trajectories that may even temporarily get out of control).

In clinical practice records play a crucial role in distributing knowledge across occupational and organizational boundaries and in pooling this knowledge for problem solving in local settings. Much work in designing an information technology systems goes into the representation of clinical records and their improvement. They provide an example of what Schmidt and Robinson (1993) call common artefacts, materialized substrates of work which help "to reduce dramatically the potential discursive overhead of cooperative working" (1993). Clinical records are the result of self-reporting procedures according to well established ways. They are intimately linked with actors' social practices and meant to make part of these practices visible and shared. Garfinkel (1967) points to an interesting feature of these documents, arguing that rather than being descriptive clinical record are used to 'normalize' clinic-patient transactions. They represent the interactions between patient and the clinic as a 'normal course of affairs'.

CONNECTING TECHNOLOGY

For an organization which is shaped by the diversity of its occupational 'milieus', the importance of local knowledge and small, informal collaborative contexts, the potential of a computer system to strengthen the sharing of information is of particular interest. The centrality of clinical records for the design of a system derives from the fact that these provide well established ways of producing "a

shared, practical, and entitled understanding of common tasks between writer and reader" (Garfinkel 1967: 201). When doctors, nurses, administrators, technicians, pharmacists use a patient chart in a particular local setting, they can read an abstracted account of this patient's specific history in their own language and at the same time talk about it across specialities. The record is simultaneously precise and explicit as well as ambiguous and implicit; it reflects general institutional arrangements and specialized practices; it is durable and adaptable. Research suggest that information technology might support a clinic's reporting procedures hereby improving the pooling of socially distributed knowledge.

The introduction of computer-based documentation practices has turned out to be a major driving force towards a 'dossier réprésentatif'. Traditionally different organizational units keep their own records which cross boundaries upon request, without however, being integrated. Typically doctors and nurses produce their own accounts of one and the same patient's history which, although kept in one folder, have to be read and understood separately and then integrated individually. The representation of various sources of knowledge in a shared medium requires that categories, classification criteria and documentary practices be homogenized to a certain extent. Such a process presupposes a high degree of explicitness. Professionals from a variety of specialities (that often possess unequal status within the organization) need to agree on a database which can serve as a facilitator of connections and synchronization. Parts of this database may be unified; if it is segmented, at least the relations between segments have to be defined.

The necessity to construct shared documents questions the specialist's unique ways of labelling and solving problems. Furthermore, it poses a threat to existing power structures, as is suggested by a study on how to design computer support for time-management tasks in a surgery clinic (Egger and Wagner 1992). The kind of transparency such a system required was perceived by surgeons as a threat to their professional autonomy and organizational privileges. Making criteria and practices explicit and visible also introduces a "new reflexivity' into domains that have been largely interactive, interpretative, intuitive, and with a strong experiential basis (such as nursing; Wagner 1993). Explicitness and transparency influence the organization's culture, in particular the delicate balance between shared 'core' values and beliefs on one hand and the 'fluctuating zone' of varied styles and practices on the other hand.

A second effect of an information technology system is its potential to provide an overview over information which is distributed over space and time. A 'dossier réprésentatif' supports the construction of an integrated view of a patient's cycle through the hospital and the associated arcs of work. Zuboff (1988) uses the 'panopticon' metaphor to capture the specific power of computer systems, their architecture creating universal transparency through illumination and a system of mirrors. Total control is only one side of the panopticon. Its other side is the construction of an integrated view. In a networked organization hospital workers are no longer restricted to their specific, specialized part of work,

each dealing with another piece or part of a patient's body and illness trajectory. Based on transparency and shared practices of representing the patient's history and related arc of work, the system supports an abstracted but 're-assembled' view of patient and trajectory, including the work of other professionals.

Within a heterogenous organizational field, such an 'integrated view' has several consequences: Firstly, social practices, professional decisions and priorities (and the implicit cultural norms on which they are based and from which they draw their legitimacy) become more accessible to discussion and reflection within an organization. 'Grey' areas of unsupervised professional autonomy are exposed to potential criticism and comparative evaluation. The performance of individuals or teams can be placed and evaluated within a larger organizational context. The 'integrated view' supports the inclusion of organizational priorities and management criteria into individual and teamwork thus making professional self-centeredness more difficult. As Hirschhorn and Farquhar conclude from their study of information systems: "As management and professional systems are tightly coupled, the organization's strategic competence depends centrally on the collective processes of talking, deciding and planning. As we have seen, the mode of knowing and deciding are discussed and developed (...) while the collective consequences of individual judgements are examined" (1985: 262f).

From this follows that information technology systems are expected to impose and reinforce discipline in complex organizations in which the direct fine-tuning and surveillance of activities is not always possible. Many hospital information systems have been primarily commissioned and designed as instruments of management control. One of their main purposes is to standardize rules and procedures, to reduce the sources of error and uncertainty inherent in staff's self-reporting procedures, to support quality control, to increase patients' safety as well as to safeguard the clinic as a medico-legal enterprise.

We will use these three arguments (and the analytical framework on which they build) to examine material gathered in three case studies:

- As a common artefact, a 'dossier réprésentatif' supports cooperative work by enlarging and enriching the area of shared information.
- It provides actors with an overview of information which is distributed over space and time (e.g. patients' trajectories, including the work of other professionals.
- As an instrument of (management) control the 'dossier réprésentatif' supports the (re)negotiation of norms and rules and helps to establish a certain degree of discipline and rigor.

2. Two paradigms

From a study of the use of information technology in twelve French hospitals three cases were selected for this paper:

- a Pediatric Public City Hospital,
- a Cardiology Clinic,
- a Regional Public University Clinic (Centre Hospitalier Universitaire).

These studies focused on cooperative work and technology in a variety of settings. They tried to look simultaneously into the lay-out of the hospital's overall system – its architecture, the design philosophy, interfaces between different organizational units – and into its use in specific local contexts.

METHOD

Contact to the case study institutions was established by sending out a short project presentation. Those hospitals qualified for a study which had implemented (or were in the process of implementing) system applications in areas of work with direct patient contact, involving more than one occupational group. We were particularly interested in studying a diversity of support platforms for information-sharing among occupations and organizational units. In each hospital a cooperation partner was responsible for the organization of a site visit, namely for selecting settings and interview partners. During these several days site visits members of the medical, nursing, data processing and administrative staff were interviewed (on the basis of semi-structured questionnaires). Moreover, we observed some of the medical and nursing staff working and asked questions. In some cases interview partners were asked to visualize their view of the overall system (including their own position within this system) as well as their ideas of sharing. Case study data was also obtained from user manuals, screen-based and paper documents, and a series of research projects on computer systems in health care published by the French government.

THE CASES

The three cases represent different approaches. The Pediatric Public City Hospital uses a commercially available product which has been (and is still being) adapted to the hospital's specific organization. A central integrated system 'core' connects all organizational units – medical and technical departments, wards. The underlying key design principle was to combine efficient documentation and information retrieval with minimal synchronization complexity. The system's prime function is to facilitate the transportation of basic patient-related data across organizational units. For this purpose, design built on a well defined set of strongly coupled functional groups representating different organizational units as well as on powerful communication mechanisms which minimize the loss of data in the system. A central application links the hospital's wards with the laboratories and the pharmacy. In combination with an automated transportation system, it regu-

lates the transfer of medical orders, specimen, diets, drugs and lab results. Walking though this newly constructed hospital leaves the impression of a modern factory: Small carts loaded with drugs or meals cue in front of the elevators to transport their cargo to one of the wards while boxes containing specimen travel on magnetic rails under the ceiling.

Clinical records are represented in a series of distinct 'hospitalization folders':

- The administrative section (patients' demographic data, admission and transfer documents, discharge information, localization of patient);
- Laboratory results, medical orders and prescriptions, medical reports;
- A brief overview over the patient's medical history;
- Nursing care plans and 'patient profiles' (defining special needs);
- Scheduled consultations and interventions.

This system of folders represents a 'body' of standardized patient-related data which is shared by different organizational units and the associated professions. The rudimentary character of this unified database is considered its major weakness. Doctors and nurses alike argue that a system that excludes their more specialized informational needs is not sufficient for supporting ongoing work. They complain about having to use a multiplicity of information sources (paper documents located in different areas as well as screen documents) which are not adapted to each other.

The second case, the Cardiology Clinic, offers the example of a highly integrated local system connecting a series of functionally coupled organizational units. After admission to the surgical department, all cardiology patients are step by step transferred through a series of locations: from one of several surgical facilities to the Intensive Care Unit (ICU) and from there to Rehabilitation. Connected is a small local laboratory. These units have developed a fairly advanced shared information technology system with its different units being linked by a local computing center. The system's architecture evolved from an isolated patient monitoring system with limited capacities to a highly sophisticated system which integrates the collection of real time data (the patients' vital parameters) during the post operative stages in the ICU with a detailed and partly standardized record of medical and nursing interventions. The patient record is a unified database which is accessible by all authorized users (medical and paramedical staff). It mainly contains clinical information:

- The patient's demographic data;
- The patient's medical history;
- A survey on previous hospitalizations;
- Medical reports;
- Laboratory/examination results;
- Detailed daily and global nursing plans on the basis of standardized nursing protocols;
- Nursing observations (in free text);
- On-line patient monitoring of real time data registered in the intensive care units;

- Medication orders;
- Instructions for the physiotherapist.

The folder containing nursing information has been designed by the head nurse in collaboration with selected medical staff. The nursing protocols were extracted from manually kept nursing records and implemented by the local computer specialist.

Our third example, the Centre Hospitalier Universitaire (CHU), consists of a campus-like collection of medical and technical departments. Each department maintains its own local database for the manipulation and archiving of medical records. These are highly structured documents with basically three partitions.
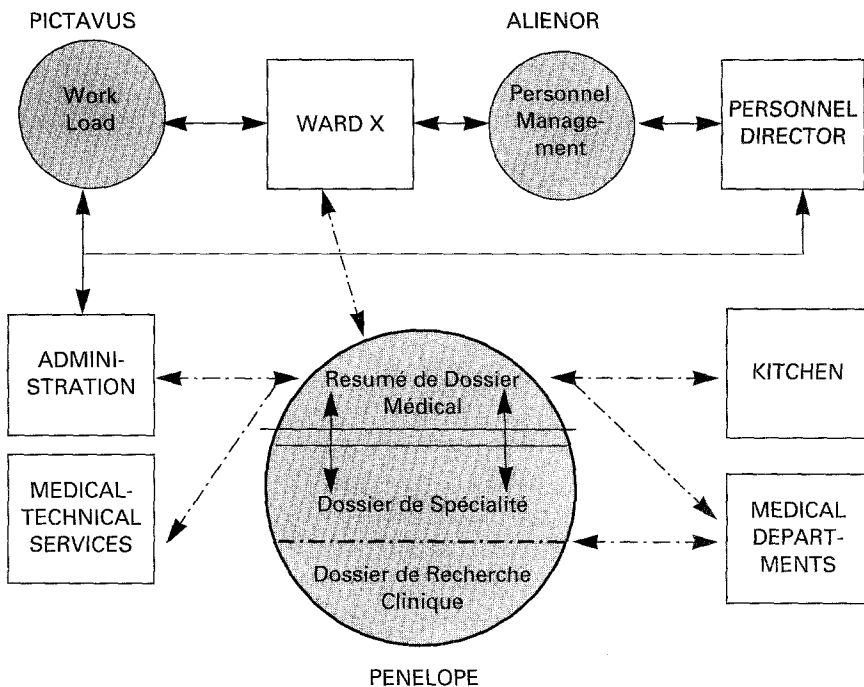
Resumé de Dossier Médical: Shared patient data
Dossier de Spécialité: Medical records
Dossier de Recherche Clinique: Special records containing research data

Fig. 1. The Fragmented Dossier (Centre Hospitalier Universitaire).

- The AM (Résumé de Dossier Médical) assembles those patient data that are of relevance for administrative purposes as well as for further references after a patient has been discharged, they are the only documents that are shared by and accessible to all units;
- The DSP (Dossier de Spécialité) contains a medical speciality's local sets of patient information;

- The DRC (Dossier de Recherche Clinique) is a collection of private data which is used by individual physicians for clinical research.

Within this distributed, loosely coupled system no communication links between wards and other units (such as the laboratories) have been provided. Personnel planning and a documentation of nursing activities on a quantitative basis are supported by local systems. Nursing staff as well as laboratory technicians cannot access a speciality's clinical records (DSP or DRC). Nursing records are kept on paper documents. This is the example of a system which has primarily been organized around the informational needs of medical specialities. Data transfer between organizational units is rudimentary and restricted to a general set of highly standardized patient information (largely demographic data, diagnostic codes, period and location of hospitalization).

INTEGRATED VERSUS FRAGMENTED DOSSIER

In a previous study (Wagner 1991b), based on case study material from an U.S. and a French hospital[2], cultural differences in the ways patient information systems are designed were analyzed. The case studies were interpreted as representing an 'integrated' and a 'fragmented' view of hospital care. An integrated patient dossier stresses those values, practices and goals which are expected to be shared by all occupational groups. Conflicting perceptions and interests have been marginalized in favour of a harmonizing image of everybody working for the same cause. The high level of transparency reflects management's success in limiting physicians' power and integrating them into the organizational decision-making process (Kim and Michelman 1990).

A fragmented dossier builds upon ambiguity and recognition of the multiplicity of organizational realities. Apart from an agreed nucleus of patient information which is accessible to everybody, the system reflects the fragmented view of local clinical contexts and diverse occupational 'milieus'. The plurality of views represented in the hospital's information technology system results from a careful balancing out of local autonomy and centralized control (a balance that Crozier and Thoenig (1976) have described as being typical of the French administration).

The three French cases present different ideas of locality and different strategies of inclusion or fragmentation. The CHU's information system mirrors the competing views of different medical specialities. Access to patient information is blocked by department, because "physicians are not willing to have colleagues look into their 'dossier visite'". The clinic's own edp-department, backed up by an administration which clearly seeks to respect the professional autonomy of its powerful medical staff, has developed a design philosophy which primarily seeks to strengthen the diagnostic and research capacities of its specialities departments.

Table 1. Two paradigms.

THE INTEGRATED VIEW	THE FRAGMENTED VIEW
Image of organization	
• High degree of integration • Process-oriented view of patient trajectories • Shared access to information	• Loose coupling • Occupation-specific view of patient trajectories • Information barriers between specialities and occupational groups
Understanding conflict	
• Shared reality • Contradiction and plurality as disruptive and threatening • Power as main 'coordinator"	• Plurality of 'cognitive maps' and values • Recognition of the multiplicity of organizational reality • Negotiation of perspectives and interests
Extent of synchronization	
• Broad, standardized communication channels • Large unified database • Unified diagnostic 'codes' • Time-cost efficiency as a dominant regulator of work	• Partial standardization of communication channels, local networks • Partially unified database with 'user modifiable filters' • Co-existence of unified and local 'codes' • Plurality of regulating 'mechanisms'

In contrast, the Pediatric Public City Hospital's system concept has been shaped by a strong administration which was primarily concerned with the efficient documentation and retrieval of 'unequivocal' information. The system mirrors the sophisticated automated transportation system. Specimen, medication and dietary orders flow one way while lab results, drugs and meals come back. One important system application supports the standardization of medication orders. Worksheets suggest typical combinations of drugs and alert physicians' attention to the precise dosage. This hospital's clientele – young and severely ill children with treatments that rely on frequent lab tests and careful dosages of often heavy chemicals – makes this system philosophy partly understandable. The fact that this is a new hospital which started recruiting its staff well after major systems decisions had been taken explains that the conflicting voices of medical specialities and professional communities were not heard to the same extent as in the case of the CHU.

The Cardiology Clinic's system reflects already existing networks of close co-operation between different organizational units which cater for the same patients at different stages of their trajectory. The number of people who have access to the dossier is limited and most of them know each other personally. Although the staff of the surgical department represents different occupational views, they all see the same patients and they know each others work well enough to be able to define common grounds. These facts taken together point to the importance of trust for information-sharing. Interestingly, the most elaborate part of the 'dossier réprésentatif' these units share is essentially nursing information. The system

reflects a special relationship in which nurses are considered as administrators of doctors' order 'only'. Physicians stressing that "nurses share the medical secret with us" not only points at the confidential, proprietary character of patient related knowledge. The decision whether to share or to protect one's dossier depends on the differential status of different types of knowledge and their carriers.

In all three French hospitals there are strong information barriers between medical departments and the hospital's administration. This is unusual, as Campbell's (1990) analysis of Canadian health information systems (most of them developed in the US) suggest. The design of Canadian systems, she argues, primarily reflects the purpose to capture costs and to deliver managerial information. In contrast to his ubiquity of the managerial perspective, the French CHU, for example, aims at establishing a balance between the administration's pressure to create data for day-to-day resource planning and control and its staff's professional interest. An interesting example is the system PENELOPE (see Fig. 1) which has been designed in cooperation with the hospital's nurses (Wagner 1991). This system primarily supports nurses' interest in documenting their high workloads (while preserving some of their niches of 'unused time'). The hospital's administration agreed to accept local intransparency and to have its access restricted to aggregated and de-individualized data. The balance of interests in this case is the result of negotiations in which administrators recognized nurses' need for local (time) autonomy *and* expected their understanding of the necessity of personnel planning. This 'negotiated order' (Strauss 1978) also reflects the fact that without nurses' cooperation it would be impossible to create a valid daily data-base.

The two 'cultures' of representing and sharing information reflect different sets of priorities. An integrated dossier to which each person working with the patient adds their bit of information is oriented towards implementing 'best practices' and a dominant view (as the Canadian example shows, most often one that is conducive to the administration's goals of e.g. cutting costs, ensuring quality control, rationalizing procedures, reducing personnel). At the same time, such a culture of transparency touches more directly upon issues of power through making priorities and the distribution of resources explicit. The fragmented dossier on the other hand gives room to a greater plurality of perspectives, work styles and interpretations within a hospital, thereby reproducing and supporting boundaries between occupational 'milieus' and territories.

3. Intensifying the collaborative effort

Analysis of a variety of documents that these three different information technology systems generate, including the practices that surround these documents, provides some interesting implications for the design of systems that support the sharing of informations and their limitations.

MULTIPLE PERSPECTIVES

In complex organizations the benefits of sharing useful and vital information are obvious. Patients are frequently moved to and from specialized machines and areas. This multiplies the possibilities of mis-information (e.g. the radiologist not knowing that the patient is on a strict diet) and of confusion over the coordination of everyone's efforts (e.g. the patient has not been prepared in time for a special treatment). One problem, however, is how to construct representations that are meaningful to all health professionals who work with a patient.

The more specialized parts of medical records are typically exempted from the 'dossier réprésentatif'. One obvious barrier against introducing standardized representations and making them accessible is the competition between different medical schools who have developed their own ways of coding a patient's illness. From the point of view of the system designer such disputes between medical schools are sometimes difficult to respect:

> In this department we have asked three different pathologists to come up with a 'bible' and each of them suggested a different one. And on top, once they have presented these three 'bibles' they have continued the argument. . . . This is simply a waste of time, we have left this question unsettled, they can do what they want. These people are not very well organized in their heads . . . (Cancer Clinic, Interview with Computer Scientists, p. 11).[3]

The CHU has developed a way around these difficulties presented by the seemingly irreconcilable multiplicity of interpretations. Its success in introducing a unified diagnostic code system largely rests on its decision to give medical specialities the opportunity to continue their own coding practices and asking them at the same time to define the relations between local and unified code.

Another hotly debated topic is whether and how to combine medical and nursing information in one single patient file. Hospitals all over the world use KARDEX systems which offer some mechanical aid for handling multiple sources of information. From the point of view of nurses several problems pose themselves. Many of the documents nurses use in their daily work are mainly based on the judgements and work of others – physicians, laboratory personnel. They have learned to read and translate them into nursing activities. At the same time nurses write their own protocols which partly document their genuinely 'own' professional work. Often these protocols contain valuable medical information. This is why doctors when in trouble over a patient bother to read them. Still, it seems impossible to integrate both viewpoints into one single document. Part of the difficulties of generating unified patient files reflects the fact that medical and nursing knowledge are not equally valued. While medical schools have established the relevance of documenting their view of a patient's illness, it is not clear what of nurses' interactions with patients
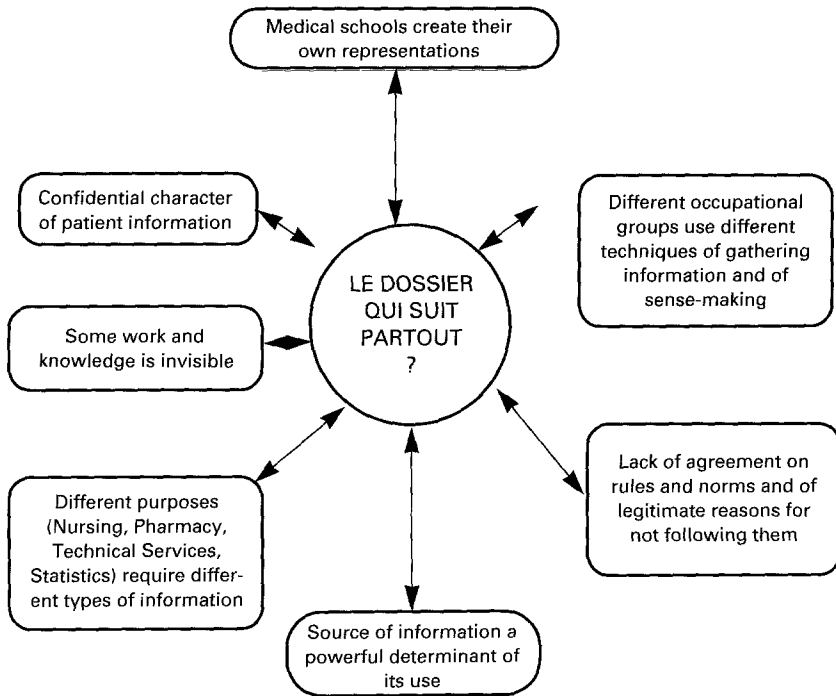
Fig. 2. Is a 'Dossier Réprésentatif' possible?

needs to be shared and preserved and according to which criteria this should happen.

This points to a more general problem: The type of knowledge useful for medical research differs from the kind of information that could specify the cause of a patient's symptoms and help plan adequate medical and nursing intervention. Similarly, information that can be used for statistical purposes and for cost control follows its own logic. Representing each particular view would not only make sharing obsolete. As a physician put it: "If there is too much choice on the screen, reality disappears" (Cardiology Clinic, p. 23). With this he points to the fact that the social construction of 'reality' is necessarily selective.

In the first phase of systems development in all three hospitals such difficult questions were often avoided by working with 'free text' dossiers or leaving physicians the choice how to represent their knowledge – "each puts into the résumé what he (the physician) thinks suitable; there are some who continue their 'essais thérapeutiques', others who have developed input masks for specific epidemologies" (Interview with Computer Specialist, p. 25). As it becomes clear that by merely continuing grown practices of documenting information systems technology is underused, steps toward a gradual synchronization of codes and practices are undertaken.

One of the obstacles to relying on and sharing computer-based information has been pointed out by Cicourel in his study of distributed cognition in a teaching hospital's microbiology lab. Physicians and nurses typically assess the credibility of the source of information which is "a powerful determinant of its influence" (1990: 222). This condition can be met by a system, as is the case in the Cardiology Clinic:

> Here everybody carries a number, from the head of the clinic to the head nurse to the simple nurse . . . The moment one puts in one's number . . . one's name is printed out. This means that there is responsibility. It is known who has done what. . . . With this system we can now directly contact the people involved. (Cardiology Clinic, Interview with Head Nurse, p. 4).

The system identifies the source of an intervention or information, thus supporting nurses to evaluate an information and establish direct contact when necessary. This principle has been built into other applications as well: the possibility to identify the physician who has done a prescription or the nurse who decided not to change a patient's bandage (she has to give a reason for not following a specific routine).

A third problem to be considered is that different health care actors employ different techniques of gathering information and of making sense of it. One task nurses face is to integrate information from a variety of patient records into a 'document récapitulatif' which forms the basis of their daily work routines. An elaborate system of small cards and stickers supports this 'projection' of each set of individual patients' records onto a work scheme which is ordered by both time and type of tasks:

> We have these paper dossiers on which doctors' orders are written and there are these little cards saying that the nurse has to administer drugs at such and such time. This reflects an organization of work which is based on partitioning the day into time periods, tailorist in a way, the assembly-line . . . And there are wall charts for the planning, with an hourly schedule and the room numbers. With these small cards, let's say we have to give a special treatment at 8 o'clock and have to repeat it at 4 o'clock in the afternoon, the nurse takes this small card, gives the patient an injection and fixes the card on the 4 o'clock slot. Our nurses like this system because they can see at one glance what needs being done. And I am as well satisfied with this system, it is quite functional. But at the same time insufficient, since it does not capture all nursing interventions. (Surveillante Générale, Centre Hospitalier Universitaire).

As we can see, in this form of representing and visualizing nurses' work a chronological, 'assembly line' organization of work overlaps the focus on indi-

vidual patients. It is primarily 'driven' by doctors' orders with nurses' 'rôle propre' being confined to a residual status. In this card and sticker system various partly conflicting perspectives have been collapsed into a chronologically organized sequence of activities. The Surveillante Générale does not question the practical usefulness of the wall charts (a typical example of a common artefact shared by the nurses of a ward). What she describes as problematic is the existing organization of work (nurses do not cater for a small number of individual patients according to their specific needs but are tied into a factory like organization of care) together with the dominance of doctors' orders in regulating care giving. As we might see from this example, representations may be both unified and practical, but based on a problematic political regime.

CREATING AND OVERVIEW

The Cardiology Clinic provides an example of a successful sharing of documents. One main application of the system is the real-time monitoring of intensive care heart patients. Vital body signs (such as heart frequency, control of infusions, temperature, urine) are registered and visually represented. This information which is generated in the ICU is integrated into a dossier which follows the patient from the operation theatre, to the Intensive Care Unit (ICU) and from there to a general ward until the final discharge document is issued. From the perspective of the ICU's Head Nurse "le dossier qui suit partout" is a truly collective information carrier:

> The nurse can already get to know the patient because of the summaries the nurses from the wards have written. When the patient arrives at the ICU we already know about the interventions that have been made... We can anticipate.... When the patient is finally settled in the ICU, we have all his vital signs on the visual display units connected to the computer... The surgeon writes down his surgery report right here. We have a laboratory that works exclusively for the surgery facilities and the ICU. They also have the computer and they communicate. They perform computations and they directly enter the results. The nurse can then directly read the lab results.... When the patient is transferred to one of the wards, we write a summary of his stay in the ICU which the ward nurse can read... They really form one unit, the wards, the operation theatre, and the post-operative ICU, due to this computer and the record that follows everywhere and the information everybody has (ICU Head Nurse, Cardiology Clinic).

The patient record is the document which is directly used by all implicated staff, whether they simply read it, react to the alarm system built into the automated monitor, add their bit of information and 'pass it on'. Nurses stress the synchroni-

zation effect of this documentation process. Relevant patient information can be retrieved before the patients arrive; lab results can be read as soon as they have been generated; physiotherapists can match their schedules with nurses' activities.

Cooperation is supported by this system in a variety of ways. The computer-supported monitoring of intensive care patients has been designed to enforce consecutive action (which then may be interactionally organized). Problematic values release a specific message which is repeated until the responsible nurse has taken action and registered it in the system. The system does not prescribe a specific intervention

> because the computer has no information about the patient's pathology. The computer only identifies an anomaly in the blood test and suggests an action, in this case a compensation of calcium or potassium would be necessary, it is time for making a prescription but without imposing it. . . . What happens is that the nurse is free how to respond, o.k. I got it, I give a compensation of bicarbonate. (Cardiology Clinic, Interview with Head Nurse, p. 22)

Although the alarm system does not assume responsibility for therapeutic decisions, it ensures that action be taken and documents individual decisions in a way that can be traced back to the responsible nurse.

While some vital parts of the staff's interactions are automated, screen-based 'shared material' also supports face-to-face communication. One example is the scheduling of physiotherapeutic treatment. In order to optimize the allocation of physiotherapists within the Cardiology Clinic, the system matches their schedules with those of the nurses. Messages concerning changes in patient's conditions are distributed automatically so that therapists can flexibly adjust their daily schedule. Information-sharing in this example focuses on the particular problem of scheduling sequential interdependencies. In this case particular kinds of therapeutic intervention are closely linked to previous preparations (which in turn depend on the patient's condition). Automated synchronization in this example helps to resolve ambiguity and also facilitates collaborative 'sense-making', e.g. the nurse explaining and legitimizing why she did not prepare the patient for the therapy.

Electronic links between wards and the hospital's pharmacy have radically changed organizational practices. Information technology has shifted nurses' responsibility for checking and portioning the drugs for each patient to the central pharmacy. This does not only allow the administration to control costs (most wards disposed of local stocks and use of drugs was insufficiently documented). By providing the pharmacist with patient information, the system introduces an additional element of control over (local) prescription practices. The pharmacist can easily check abundant use of certain drugs (such as antibiotics) or point to specific risks and to the incompatibility of prescriptions. In problematic cases

"there is an immediate dialogue between the pharmacy, the physician and the nurse, in both directions" (Cardiology Clinic, p. 14).

Analyses of electronic media often focus on the constraints they impose on the diversity of ways of experiencing and communicating (e.g. Raulet 1988). These examples suggest the opposite effect. Screen-based documents provide actors with situationally created documents which become part of their interactions and as such stimulate discussion, prompt immediate intervention, resolve uncertainty. Integrated into interactionally organized activities, these documents unfold effects which Serres (1980) has described using the 'parasite' metaphor. This metaphor expresses the multiple and changing faces of artefacts, their ambiguity and variability. They may be perceived at a given moment as "'disrupter' of customary procedures, as 'host' who stimulates a constructive new approach to a particular problem, or as the included, excluded 'third actor', the parasite, who is present without being in the focus of attention" (Bardmann et al. 1992: 83) From the uses of screen-based accounts (such as unified patient records) in the setting of a hospital we can see that they:

- support implicit communications which are made explicit in case of an ambiguity to be resolved (the pharmacist or physiotherapist getting back to the ward nurse);
- afford an overview of the patient's trajectory that would otherwise not be available;
- "embed a partial model of the situation to be managed" (Schmidt and Robinson 1993) (e.g. nurses work with detailed screen-based daily nursing plans which are based on a standardized trajectory scheme for a patient through postoperative care);
- serve as a reconstructable record of transactions between patients and clinic personnel (as such they are records of a 'therapeutic contract' (Garfinkel 1967));
- provide useful templates for personnel's self-reporting procedures.

It is this multifunctionality which makes common artefacts so useful in collaborative contexts (Schmidt and Robinson 1993).

IMPOSING DISCIPLINE

While these multiple functions facilitate cooperation, they at the same time serve as instruments of control. This control is not necessarily exerted from "the top". As Howard (1987) points out, the kind of 'overview' an integrated computer system provides intensifies the social awareness of actors on all levels of the organization. Gioia (following Perrow) distinguishes between two forms of control, control that derives from programs, policies and standardized procedures, and control that resides "within the interpretation systems of the employee and is dependent upon his or her social constructions" (Gioia 1986: 66). Information systems, so it seems, combine both methods of 'unobtrusive

control', as working with computer-based representations of patient-related knowledge socializes into specific perceptions and social practices.

In the French debate one major theme is how to use information technology for establishing standards of nursing care. The Cardiology Clinic's Head Nurse (who has been participating in these discussions on a regional and national level) has initiated the development of screen-based care plans and nursing protocols. While the clinic's patients are located in intense care, they are in a critical condition with unexpected events prevailing. This is why the information to be shared within the network of physicians and nurses working in the ICU is largely created spontaneously and as free text. The Head Nurse calls the nurses' protocols their "transmissions en réalité", nurses view themselves as working "à la demande du patient'. As soon as the patient is transferred to the Rehabilitation Ward, the more routine nursing activities start. By analyzing hundreds of patient dossiers, the Head Nurse together with physicians has tried to identify the best ways of doing things. This process has served to establish clear norms, including legitimate reasons for not following these norms. It builds upon a model trajectory of patients through various stages of a rehabilitation process.

One routine intervention is the changing of bandages for which a time schedule including specific indicators has been defined.:

> This introduces a certain degree of rigour. The bandage, this needs to be done at a specific stage, when it is done earlier, the computer asks why, why are you changing the bandages? There (pointing to an example on the screen) it has been changed because it does no longer fit closely or even leaked, because the patient's temperature rose, or an anomalous tension or pain, then she has the possibility to enter why. . . . And as a consequence everybody does the same things, in a well defined way. (Cardiology Clinic, Interview with Head Nurse, p. 10)

For nurses who use it in their everyday practice the system offers practical help in keeping track of their responsibilities for all patients. At the same time it provides a framework within which to describe and legitimize nursing interventions. Moreover, this care plan plays an important role in the communication process between nurses and patients. Nurses use it when explaining to their patients the necessary steps to be taken until they will be able to leave the hospital. The Head Nurse perceives this feature of the system as an important achievement. In her eyes it effectively helps to reduce patients' uncertainty.

While the design of the system initiated an important process of defining norms and routines, its use establishes a certain degree of discipline and rigour. This is demonstrated by the hospital's edp-specialist who tells the story of a nurse transferring a patient to another room. As a rule, most rooms host one or two and at a maximum three patients. This particular patient was the fourth one in this

room and this is why he got lost in the system (since there is no provision for four-bed arrangements, for good reasons):

> It's them who have imposed the principle of three beds, that's why I told them, you violate your own law... you can't change everything, because one patient is not in the bed he is supposed to be in, they have mismanaged their part, and this means that a kind of self-discipline has been established and a conscientiousness, and one is sure to find everything again... in case one follows the established rules, it is important to know how to define the rules. (Cardiology Clinic, Interview with Computer Specialist, p. 28).

The computer in this anecdotal incident is described as an unrelenting reminder of (self) imposed norms and rules. Nurse's complaint that one of her patients disappeared from the system, contrary to her own interpretation, documents that she has broken a rule. This fact is made visible throughout the shared system e.g. activating the edp-specialist who in turn takes the opportunity to remind the nurses of their own rules. The memory of the information system strongly intervenes in staff's collaborative relationships, making practices transparent, exposing rules, eliciting arguments (and eventually also discussion and reflection of those rules as well as of legitimate reasons to break or circumvent them).

4. Restructuring professional relationships

Information technology systems have a strong impact on the collaborative relationships in complex organizations. The technical transfer of information throughout the organization facilitates the coordination of effort. It is only possible to the extent that actors from different organizational units and occupational milieus engage in processes of negotiating and agreeing upon how to construct shared representations of 'reality'. The cases suggest that this can be successfully done, in particular in areas of overlapping competencies and shared responsibilities. Imbedded in interaction contexts, these computerized documents of a patient's cycle through the hospital serve as 'shared material' to which actors refer to. "Le dossier qui suit partout" connects organizational units which have a strong incentive to share information and have developed dense informal relationship. These different units are tied together by the patient's trajectory. Although representing different approaches to the patient's illness, physicians, nurses and technicians in these units have learned how to pool their expertise and create situationally shared interpretations. These common grounds can partly be supported by an information system.

Sharing such an information system on the one hand strengthens existing informal relationship with known colleagues in familiar places. Each time a physician or nurse uses 'shared material', these relationships are implicitly

evoked. In this sense the system supports their continuity. At the same time these relationships become partly formalized, as they are actuated without actors making an effort to get in touch and communicate. Their co-presence is no longer required. In cases of emergency, ambiguity or contradiction, however, these automated connections are mobilized, when actors get together to discuss and intervene.

The formalization of relationships does not only to a certain degree enforce collaboration, it also creates new dependencies:

> One of the problems is that you have to convince everybody, to make everybody collaborate in this system. If we for example don't put in the weight of a child, people in the pharmacy are blocked because they can't check the correspondence between the dosage and the weight or surface of the body. There are multiple interactions, the system is centred on the patient, all parts of the patient, and if not every single actor puts in his informations on the patient, there is a problem. (Pediatric Clinic, p. 33).

Information-sharing requires that each person add their bit of information to the 'dossier'. This is particularly important in organizations like hospitals where situationally created information often gets lost and cannot be retrieved. Before information (e.g. an X-ray, a waiting list) disappeared and had to be reconstructed, with immediate problems having to be solved locally. With the explicit definition of responsibilities in an information system, formerly hidden or not clearly localized dependencies become visible and change their character. In this sense the 'new dependencies' are not new. They rather become more relevant in an information system and their malfunctioning is more acutely felt.

The design of the three systems also reveals some of the limits of information-sharing. These are partly due to the high degree of professional specialization within hospitals, partly grounded in differences of status and power. Constructing a 'dossier réprésentatif' supposedly changes the relationship between occupations. Acker and Denis (1987) emphasize the re-positioning of occupations within a particular field of work as one of the main effects of information technology. The power issues that pervade the collaborative relationships of the local communities observed, also mirror the politics of the surrounding larger organizations – the hospital administration, the professional communities, unions. This is why an assessment of a computer system's effects on e.g. nurse-doctor or junior-senior staff relationship is difficult.

In all cases examined nurses perceived computers as an ally in their struggle for professional autonomy and recognition. They showed a strong interest in using the systematizing power of computer documentation and data processing for making the complexity and high level of skill of nursing activities visible. Defining a 'core' of nursing diagnoses that legitimizes specific nursing interventions, should help nurses to focus on their own pre-planned nursing 'projects'

(instead of carrying out doctors' orders only). The Head Nurse of a Cancer Center formulates this policy by referring to the results of a statistical survey:

> There is a strong correlation of the medical diagnosis, the treatment and the nursing diagnosis. We dispose of thousands of dossiers which show us that there is very strong correlation. This is of high interest to us, since it confirms the importance of including the nursing diagnosis in the set of indicators that describe the activities of a hospital on a quantitative and a qualitative level. (Infirmière Principale, Centre Anti Cancéreux)

Computers are seen as supporting a level of systematization of nursing knowledge that makes it 'scientific' (based on theoretical models, empirically tested knowledge, scientific reasoning).

The care plans in use carry ambiguous messages. They have been primarily designed to 'normalize' routine nursing activities (rather than to highlight nurses' specialized skills). Their clear contractual character makes them useful for purposes of quality ensurance and control. Nurses' focus on their 'rôle propre' is further made difficult by authority relationships, requiring *ad hoc* availability and flexibility in meeting shifting demands (e.g. to take over 'non-nursing duties' such as cleaning, errands, office work *and* to support the diagnostic process). At the same time they make nurses' invisible work noticeable in the local community and in the surrounding organization. Visibility also means financial acountability, assessing the value of care-giving in monetary terms. Further studies are needed for evaluating how these developments will in the long run affect nurses' position within the field of hospital work.

5. Conclusions

This study has mainly focused on the policies of information-sharing as visible in shared documents, their content and their multiple users and practices of use. From our observations some suggestions concerning the design of hospital information systems can be derived. They pertain more to the design of information objects to be exchanged than to the characteristics of the distributing system.

Since time is an extremely valued resource in a clinical setting and opportunities for regular meetings restricted, the nature of support for cooperation is essentially informational, with clinical records at its core. Consequently, the success of systems that support collaborative relationships strongly depends on the ways shared material is constructed. This is reflected in the design philosophy of hospital information systems. They focus on transferring existing records onto a screen and on improving their informational quality. It is obviously vital to analyze in-depth documents already in use and the practices of sharing or withholding information that surround them. Records are a product of cooperation as well as of

selective access and exclusion. The cases help to understand the advantages as well as the problems of an integrated *vis à vis* a fragmented dossier. Under the political regime of a powerful administration interested primarily in cost control, a unified patient record might be dictated by centrally defined rules and practices. For example, extending the electronic links between wards and the central pharmacy to the administration makes central regulation of medical prescription practices relatively easy. The fragmented dossier is more likely to preserve the plurality of perspectives, work practices and interpretations within a hospital. It at the same time may support the powerful hierarchy of professions (with the 'head of service' as the most influential player) and the associated 'politics of invisible work' (Suchman 1993).

Whilst CSCW derives from a commitment to establishing shared contexts, it is important to carefully examine and respect the control requirements of different groups of users. When looking more closely into the idea of a 'dossier réprésentatif' as expressed by a variety of people in the case study institutions, we have identified four different meanings which can be related to different systems philosophies (Rodden et al. 1992).

- 'Dossier réprésentatif' refers to a 'core' document that is shared by all organizational units. It contains basic patient-related data which are used for creating an overview for (local, regional or even national) administrative bodies. It also serves as a prime source of reference for admission and referral to external institutions. Access to such a core document is typically based on a client-server model. A critical question is whether the existence of such a dossier supports the implementation of centrally defined codes (such as the Diagnostic Related Code DRG in the US) and how these affect local practices.

- A second meaning associated with the 'dossier réprésentatif' is to support communication links between spatially distributed people with different degrees of proximity to the patient. This type of application which basically regulates the transfer of data (in real time) is based on a communication model. As mentioned above, it does not only allow the timely retrieval of vital information but at the same time may create new contexts for direct communication (for example when the pharmacist rings up the ward nurse to discuss a patient). The 'pharmacy case' suggests that also formerly disconnected units may find a rationale to share information which in turn will strengthen the opportunity for dialogue.

- A computer system can facilitate people's browsing through a variety of different folders that embed different practices and models of the work to be done without enforcing a translation of these documents into a unified schema. It is basically an improved KARDEX system which can be more easily manipulated and is delocalized. In such a 'browsing system' access control is a major challenge. If everybody is included, from the receptionist, to the colleague from pathology or internal medicine, to the accountant and director of personnel, than questions of who should be allowed to read, add, modify, extract for their own purpose become paramount. Public and private spaces and transi-

tions between them have to be defined carefully. The system's overall design strongly depends on the consideration of those domains in which the issue of multiple perspectives is particularly acute.

• Finally, there is the dossier which is shared by a collaborative ensemble who has a strong incentive for enriching and enlarging its array of communal resources. As we can see from the 'cardiology case', the 'dossier qui suit partout' has been explicitly designed to support work in areas (as defined by the patient's trajectory) in which the viewpoints of different occupations have to meet and converge to a certain extent. It is not supposed to cross these boundaries. It is shared in the sense that all implicated actors make their part of work with the patient visible for the ensemble. It may be designed as a virtually co-located or a locally remote system (Rodden et al. 1992), depending on the intensity of cooperation needed. Multimedia technology would make it possible for example for the ICU nurse and the (remotely located doctor) to communicate about the patient's condition as represented on a visual display.

As we can see from the case studies, the hospital as a medico-legal enterprise with a strong hierarchy of knowledge and power imposes restrictions on information-sharing. The contractual character of medical and nursing documents makes it necessary to build upon conventional and routine ways of ordering and legitimizing work. Hospitals are not especially supportive of the CSCW commitment to encouraging easy transitions between public and private spaces and to making one's special contribution to a shared problem immediately visible and 'heard'. Still, CSCW inspired design could contribute to increasing awareness of the relevance of 'underrepresented' activities and knowledge for collaboration. The rich diagnostic material created by the non-medical staff would be a prime candidate for such a program.

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Notes

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2. The French case is the "Centre Hospitalier Universitaire" in which we were able to carry out a second, follow-up study.
3. Citations are drawn from the Appendix to the Project Report which contains the transcript of interviews.