Cooperative Document Management

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1 Introduction

Healthcare is a multidisciplinary setting where professionals from several disciplines need to work together to maintain or improve the health of patients. In recent years, cooperation in healthcare has become more and more important for two reasons.

The first reason is that the division of labour within healthcare has become more pronounced as patient care has become more complex with the introduction of new techniques and machines such as keyhole surgery or computer tomography. Today, nurses carry out actions that used to lie in the responsibility of doctors. For example, some nurses are allowed to give injections, nurses in hospital can decide when it is necessary to administer drugs prescribed by doctors as "prn" (standing for "per re nata", "as required"). Some tasks previously carried out by fully qualified nurses have been taken over by auxiliary nurses or administrative staff, e.g. washing and dressing of patients, feeding patients, serving meals, requesting medical notes from patients' GPs or hospitals etc. (Newman, 1990).

The second reason for the increased importance of cooperation in healthcare is that a more holistic approach to patient care is now taken. Patient care is no longer solely medical care but involves input from healthcare professionals coming from several disciplines (Morgan, 1993). As Newman (1990) states, the nursing profession has changed from providing subordinate duties to doctors, to being responsible for patient care with autonomous nursing goals. Today, it is not permitted to discharge a patient from hospital simply on the grounds that his or her medical treatment has finished. Nursing or social needs have also to be met before a patient can be allowed home.

As is to be expected, the areas of healthcare that see the greatest changes towards truly shared patient care are the ones where professionals from different disciplines have a large impact on the shared task of improving a patient's state of health. For example, Geriatrics is a highly cooperative area. The different needs of elderly people can only be met by efficient cooperation of professionals from several disciplines (Schoop, 1998; Schoop and Wastell, 1999).

However, the reality is sometimes different: professionals do not always understand each other and cooperation does not always work. Healthcare professionals have particular interests concerning the patients that are determined by their professional role. For example, a doctor is interested in a patient's medical complaints whereas a nurse needs to find out the care needs; a physiotherapist is interested in a patient's needs concerning daily living in order to ensure a maximal safe level of independence. According to their different interests and tasks, the professionals will notice different things when looking at the same patient which they will write down in the appropriate documents.

The move towards more cooperation is also reflected in the management of documents. The conventional practice is that each discipline manages its own documents. For example, doctors keep the medical notes which reflect the medical treatment plan; the nurses' medium of documentation is the care plan; physiotherapists and occupational therapists have again separate documents to manage. It is easy to imagine that

the practice of keeping separate documents relating to the same patient can complicate or indeed inhibit communication and cooperation:

> "The recording of care was held separately by each profession, the result being a collection of random notes: doctors' notes, nurses' notes, physiotherapists' notes, and occupational therapists' notes – hardly an example of an integrated, team approach to care. (…) How, in these circumstances, can there possibly be a holistic approach to patient care? " (Morgan, 1993, p. 38).

For example, if a nurse needs to find out results from a medical test, (s)he would have to look in the medical notes in which (s)he might not be able to find these results since (s)he is neither familiar with the record's structure nor with the particular professional terminology used by the medical staff.

To overcome these problems, there have been attempts to develop cooperative patient record systems that would contain all clinical information about a patient and provide appropriate interfaces to the relevant data for different professional groups. For example, the PEN&PAD Geriatrics project aimed at developing a cooperative system that could be used by doctors, nurses, physiotherapists, and occupational therapists (Hardiker et al., 1995; Heathfield et al., 1992, 1994). However, in the end only a nursing record system and a medical record system were designed. These systems represented the different views on patient data and the different requirements of data representation. The goal of supporting cooperation was not realised as these two systems were separate systems without the possibility of exchanging information between nurses and doctors.

Another approach to overcome the problems of keeping separate documents is the development of shared systems for documentation (Layton, 1993; Morgan, 1993; Schoop, 1998; Schoop and Wastell, 1998) which will be referred to as cooperative document management systems (CDMSs). These systems are information systems in which the documents are cooperatively managed. All information that is important for more than one discipline is recorded in the shared documents, e.g. shared objectives, multidisciplinary treatments goals, diagnoses, results from assessments. Obviously, this form of cooperative document management does not replace conventional records all together as there remain parts of the clinical record that are only relevant to one professional discipline. Cooperative document management does not mean an overload of irrelevant information but rather the support of cooperative plans of care (Schoop, 1998). It is increasingly recognised that cooperative document management systems can help to avoid cooperation breakdowns since they aim to provide a central reference point for all disciplines to focus on a cooperative plan of care (Morgan, 1993). The whole process from admission to discharge would, therefore, be visible at one glance at a level that is detailed enough to coordinate the different activities and to work towards effective discharge planning with clear responsibilities. This new initiative thus emphasises the importance of cooperative document management for effective multiprofessional cooperation and written interdisciplinary communication that are both vital to provide effective care of patients.

However, there have not been any structured approaches to cooperative document management as shared record systems have mostly been developed by healthcare professionals on an intuitive basis to help them with their practical routines. Cooperation breakdowns cannot be prevented and communication via such cooperative systems has been shown to be problematic (Schoop and Wastell, 1999). Therefore, we argue that a fundamental overhaul of cooperative document management is required. It is not enough to provide document management systems with different interfaces

according to the requirements of doctors and nurses. The fundamental problems that exist need to be solved first before any implementation can take place effectively.
In the present article, a novel approach to cooperative document management in multidisciplinary healthcare will be introduced that is empirically grounded while at the same time influenced by social theories and formal logics. It will be shown that most breakdowns in communication and cooperation can be avoided and thus, effective content-based management of patient-related information is made possible. Document management in healthcare has specific characteristics which differ significantly from those in "classical" application areas such as offices or businesses (as will become clear in this report). Cooperative document management is in itself an interesting area both for researchers and practitioners as it requires not only an efficient management of documents but also efficient cooperation of different professionals. In healthcare, cooperative document management concerns, on the document side, the different types of patient notes and records and, on the side of professionals involved, the multidisciplinary work of healthcare professionals from several different disciplines. Cooperative document management in healthcare is a new issue that is expected to have a great influence on work patterns and the handling of documents. The approach that will be illustrated in this report for the area of multidisciplinary healthcare can be applied to other areas. Thus, while healthcare is used to illustrate the approach, we can abstract from this area and will present an approach relevant to *cooperative* document management practices in general.
The outline of the report is as follows. In order to provide a solid empirical platform for the present work, ethnographic investigations were conducted in a multidisciplinary healthcare environment. Section 2 will discuss the particular ethnographic methods that were employed. Furthermore, it will summarise the main results of the studies that are relevant for the introduction of computer-based document management systems.
The theoretical background of the work will be introduced in section 3. The most significant finding of the ethnographic work was that the main problems centred around communication. Fundamental communication problems between doctors and nurses existed which were an obstacle to smooth and effective cooperation. These problems were especially severe in the case of written communication which has knock-on effects on document management systems. This prompted the author to look at theories of communication as a theoretical basis for a new and more theoretically rigorous approach to the design of cooperative document management systems.
The novel approach to cooperative document management will be introduced in section 4. The empirical data and the relevant theoretical elements are combined into a powerful framework for the design of effective cooperative document management systems. The approach will be empirically evaluated in section 5. An outlook to future trends and a final discussion (section 6) will conclude the article.

2 Empirical Studies in Multidisciplinary Healthcare

To collect the necessary data to provide a solid empirical platform for the work, ethnographic investigations have been carried out in a multidisciplinary healthcare setting. It was decided that the best way to find out about work practices, cooperation and documentation patterns, and potential problems would be to conduct ethnographic studies. It was felt that only by observing the work and interactions of cooperating professionals could the perspectives and the existing problems be assessed and

analysed. Ethnographic studies aim to be free of the researcher's own prejudices and presuppositions to provide accounts from the participants' points of view:

> "Rather than foist the categories, terminology and procedures of some academic theoretical stance, one takes the stance of the actors in that setting themselves." (Bowers, 1996, p.126)

Ethnographic investigations are relatively unobtrusive and cause little disruption to the setting observed (Burgess, 1984).

The aim of these ethnographic studies was to find out in general about document management and more specifically about

- work practices
- information flow and possible obstructions
- documentation practices
- cooperation structure including areas of conflict and areas where cooperation worked well
- the data and the related level of abstraction and detail that each professional group needed in order to achieve their tasks
- what terminology was used in each professional group
- typical communication problems
- areas where IT could support the interaction between different healthcare professionals and the work of multidisciplinary teams

Ethnography has been used, albeit sporadically, in relation to the design of computer systems in a variety of work settings such as offices (Rouncefield et al., 1994; Suchman, 1983), air traffic control centres (Bentley et al., 1992a,b; Hughes et al., 1992, 1993), ambulance control centres (Martin et al., 1997), telephone banking centres (Martin et al., 1998), travel centres (Bullock and Goble, 1998), and the fashion industry (Pycock and Bowers, 1996). Ethnography has been mainly used a s a tool for requirements analysis. As such the ethnographic findings have sometimes challenged fundamental design assumptions. For example, in the study of air traffic control (Bentley et al., 1992a, b; Hughes et al., 1992, 1993) the basic assumption that routine tasks should be delegated to machines was questioned due to the ethnographic findings. It was observed that some routine tasks (such as putting flight strips in appropriate folders) include important checking procedures; this suggested that they should not be directly automated (Bentley et al., 1992a).

There has also been criticism of ethnographic approaches: Plowman et al. (1995) ask what ethnographic work studies are for as most tend not to translate their findings into concrete design recommendations.

In section 2.1, the ethnographic methods used for the present work will be discussed. Sections 2.2 and 2.3 will summarise the main issues arising from the qualitative research.

2.1 Applied ethnographic methods

The first step in any ethnographic study is to answer the four 'w's, i.e. where, who, what, when. The research site, the participants, the events, and the particular time need to be selected. As it is never possible to study everything in a setting, **sampling** methods need to be applied.

The research site was an acute Geriatric ward with twenty-six beds which is part of a Geriatric hospital in a large English city. Geriatrics was selected because the shared care of the elderly is a highly cooperative area where many different disciplines such as doctors, nurses, physiotherapists, occupational therapists, and social workers work together to provide a shared plan of care. The ethnographic investigations concen-

trated on the groups of nurses and doctors as these are the main contributors to the care process. The selection of events for the research followed directly from the overall aim of the project and the selection of informants. The daily work of nurses and doctors and the ward rounds and case conferences as manifestations of multidisciplinary communication and cooperation on the ward were observed.

Participant observation is the ethnographic methods that was primarily used in the present work. Participant observation involves observing people in a natural setting over a prolonged period of time, and talking and listening to them. The roles that an observer can take can be distinguished into active or passive, open or covert roles (Schatzmann and Strauss, 1973). The main role of the author was "participant-as-observer" where a researcher sometimes participates as well as observes. The role as observer is the primary one and is openly declared. However, the role varied during the field work: For example, in case conferences and when observing and analysing the document management practices, an observer role was mainly adopted. Here, notes were taken and no input was provided unless being invited to comment.

Once familiar with the work practices, less time was spent observing and informally talking to the participants and more time was spent carrying out **interviews**. Conducting interviews implies a good knowledge of the structure and dynamics of work in the setting observed. Observing is then used to confirm ideas rather than testing new ones (Schatzmann and Strauss, 1973). Semi-structured and unstructured interviews were performed with nurses and doctors about many aspects of cooperative documentation. Furthermore, interviews were carried out in the following way: A nurse was asked to summarise all relevant information about a patient for another nurse and then for a doctor; likewise a doctor was asked for a summary that (s)he would give to a colleague and one that (s)he would pass on to a nurse. These interviews showed the different information requirements as well as the assumptions of what is necessary for the other professional group.

As the focus of the ethnographic studies was on document management practices for cooperative work, **document analysis** played an important role. Three forms of documents were analysed: the care plan, the medical notes, and the multidisciplinary treatment goals (MDT) folder. The care plan is the nurses' main medium of documentation whereas the doctors record in the medical notes. All information concerning more than one discipline is recorded in the shared documentation system, i.e. the MDT folder. It is confidential and may only be read by authorised healthcare professionals (as opposed to the care plan which is stored at the end of the patient's bed and which can be read by patients and relatives).

The documents in this shared system contain the multidisciplinary goals, the responsible persons, dates, and comments relevant to the achievement of the multidisciplinary treatment goals (see figure 1).

Date	Multidisciplinary Goal	Action/Referral By	Review Date	Achieved Date	Comments
11/5	review discharge plan	medics, nurses	16/5	13/5	unable to discharge due to an acute angina
13/5	Nurse will refer V. for relief of pain due to arthritis	nurse referral to physio	13/5	13/5	
17.6.	To speak with family about nursing home	social worker	24.6.	21.6.	family anxious to have her home daughter will look after her

Figure 1: An entry in the shared documentation system

Observations were carried out in the ward rounds and in the case conferences regarding which information was documented in the shared system. Furthermore, the dynamics behind the data entries were reconstructed in the following way. Firstly, the author and the recipient of that were established. This was not as easy as it might seem because author and recipient are not always obvious. For example, in the third entry of figure 1, the request was made by a nurse for the social worker to speak to the patient's family. In this case, the recipient rather than the author is recorded (as opposed to the normal practice as in the first entry). Secondly, it was found out what type of action was referred to. Thirdly, possible problems were highlighted. The last step drew on the observations of existing communication problems in that environment.

For an extensive discussion of the ethnographic work conducted in the hospital, the interested reader is referred to (Schoop, 1998).

2.2 Results of the ethnographic studies

This section will summarise the results of the ethnographic studies. The discussion starts by giving an overview of the normal document management practices on the ward. Example documents of a female patient called Linda Smith[1] will illustrate the discussion. The analysis of the ethnographic work helped identify key design issues, i.e. those things that need to be considered for cooperative systems and document management in particular. The overview in this section exemplifies the key issues that will be discussed in section 2.3.

Both doctors and nurses are responsible for documentation which is a legal requirement. Doctors document in the medical notes whereas the nurses' medium of documentation is the care plan. The staff on the ward have developed a shared documentation system which is called MDT folder or MDT system. All information concerning more than once discipline is documented in the MDT folder for which all professionals are responsible.

[1] Patient-identifiable data has been changed. The documents show direct transcripts of the original entries.

CONFIDENTIAL HOSPITAL NHS TRUST

WARD *123*

HOSP. No. *1234* Admitted *23.1.95* CONSULTANT *WBS*

SURNAME: *Linda*
FORENAME: *Smith*
LIKES TO BE KNOWN AS:
ADDRESS: *Manchester M13*

PREVIOUS OCCUPATION:

WHO WAS INFORMED? *Husband and daughter*
TIME: *1.30 pm*
DATE: *23.1.95*

PERSON TO CONTACT IN AN EMERGENCY: *Daughter*

NAME: *Mary Miller*
ADDRESS: *Stockport SK6*
TELEPHONE NO. *4567890*

TYPE OF ACCOMMODATION:
(Tick as Appropriate)

HOUSE: √
FLAT (GROUND):
FLAT (OTHER):
BUNGALOW:
WARDE (RES.):
WARDEN (MOBILE):
E.P.H.:
NURSING HOME:
RESIDENTIAL HOME:
DELETE AS APPROPRIATE:
BED: UP/DOWN
TOILET UP/DOWN
WHO DOES PATIENT LIVE WITH? *Husband*

AGE: *66 years*
D.O.B. *8.8.28*

MARITAL STATUS:
(Tick as Appropriate)
SINGLE
MARRIED √
DIVORCED
SEPARATED
WIDDOWED

RELIGION: *C/E*

MEDICAL DIAGNOSIS

NEXT OF KIN:
RELATIONSHIP: *Husband*
ADDRESS: *Sunnyfield*
Manchester M13
TELEPHONE NO: HOME:- *9876543*
WORK:-

G.P.NAME: *Dr Hamilton*
ADDRESS *Romiley*

DOES THE PATIENT HAVE ANY DIFFICULTY WITH: REASON
STAIRS: YES/NO *uses stairs to*
BEDROOM: YES/NO *go to bed only*
TOILET/
COMMODE: YES/NO *has commode*
BATHROOM: YES/NO *downstairs*
HEATING: YES/NO

Figure 2: Example of first page of admission form in MDT folder

CARERS:

WHO:	WHO:
SHOPS: *Husband* FREQUENCY: CLEANS: *Husband* COLLECTS PENSION: ″ COOKS: ″	LAUNDRY: *Husband* GETS MEDICINES: DOES PATIENT CARE FOR ANYONE ELSE? WHO? *No*
HOME HELP: *No* HOW OFTEN: WHAT FOR?	MEALS ON WHELLS: ~~YES~~/NO
DISTRICT NURSES: *No* HOW OFTEN: WHY? OTHER AGENCIES INVOLVED:	COMMUNITY NURSE FOR THE ELDERLY: NAME: CPN: ~~YES~~/NO SOCIAL WORKER: ~~YES~~/NO NAME: ADDRESS: TELEPHONE NO:
URGENT DOMESTIC PROBLEMS	

Figure 3: Example of second page of admission form in MDT folder

HOSPITAL

Name: *Linda Smith* **Hospital Number:** *1234* **Consultant:** *WBS*

Expected Length of Stay: **Revised Discharge Date:**

Planned Discharge Date:

Short Term / Long Term Multidisciplinary Team Goals

Date	Multidisciplinary Goals	Discipline/Name	Review Date	Achieved Date	Comments
23.1.95	*To investigate cause of diarrhoea blood stained*	*Medics / Nurses*	*26.1.95*		*Stool specimen sent on 24.1.95 commenced on Loperamide*
26.1.95	*To commence 3 day faecal fat collection. Doctor will liaise with labs first and then let us know how to go about it. for ? malabsorption*	*nurses/doctor*			*weigh her ✓ commence on feed chart F.F.C commenced on 31.1.95 * To finish on Friday 3pm**
31.1.95	*Daughter wishes to speak to WBS*	*nurses/doctor*	*2.2.95*	*2.2.95*	*Appointment made for 12.30 pm on Thurs 2.2.95 daughter aware*
1.2.95	*To ↑ patient's mobility*	*Amy/physio*	~~*1.2.95*~~ *2.2.95*	*2.2.95*	*Patient is safe to walk with Zimmer frame*
2.2.95	*For discharge on Friday after 3pm*	*MDT*	*3.2.*	*3.2.*	*OPD with Dr. Gibbs who will review results of faecal fat collection Rels aware*
15.2.95	*RE-ADMITTED ON 15/2/95 To identify cause of re-admission (seems to be several problems)*	*MDT*	*19.2.95*		*Faecal Fat collection showed that she was passing fat not absorbing*
16.2.95	*To find out when she is due her neocytamin injection*	*Holly/Jill*	~~*17.2.95*~~ *19.2.95*	*18.2.95*	*Edith aware + will let us know*
16.2.95	*To assess social situation*	*MDT*	*22.2.95*		*Referred to Liz S/W*
16.2.95	*Poor Appetite Weight Loss*	*Dietician*	*17.2.95*		*Referred to Dietician*

Figure 4: Example of first page of MDT sheet in MDT folder

HOSPITAL

Name: *Linda Smith* **Hospital Number:** *1234* **Consultant:** *WBS*

Expected Length of Stay: **Revised Discharge Date:**

Planned Discharge Date:

Care 'Pathway'

Date	Investigations and Referrals	Action	Referral	Name	Review Date	Achieved Date	Comments
2.2.95	*To refer to gastroenterologist for opinion (Dr. Gibbs)*		√	*doctors*			
16.2.95	*To chase up Dr. Gibb's referral*						*Hopefully to be transferred under his care and then for her to return to us*
18.2.95	*To refer to chiropody*	*Jill* →			*24.2.95*		*Form done + sent*

Figure 5: Example of second page of MDT sheet in MDT folder

On admission nurses fill in an admission form for the patient which is then stored in the MDT folder. Figures 2 and 3 show the sheet for Linda Smith.
Based on both the doctors' and the nurses' assessments, short and long term multidisciplinary goals and the process of shared care are then recorded in the shared system (see figures 4 and 5[2]). The MDT folder is aimed at showing the whole process from admission to discharge at a glance for all professionals involved in the shared care. When the patient is ready to be discharged, a discharge sheet is filled in by the named nurse. Its purpose is to act as a check list for the nurses who are responsible for preparing patient discharges. On it, the nurse records the discharge arrangements such as transport home, outpatient appointments, referral to district nurses, medication etc.

2.3 Key issues

This section will summarise the key issues emerging from the field work that need to be considered for introducing technology support for multidisciplinary cooperation (Schoop, 1998). Many of the issues relate to the use of documentation. In section 6.2 the issues as a whole will be revisited and it will be discussed which of them have been accommodated in the present work and which of them have not been addressed.

1. Cooperative document management is important but breakdowns can occur.

It was found that one of the most important problems in multidisciplinary interaction is the breakdown of communication. The MDT folder is a cooperative document management system aiming to support information exchange, coordination of care, and effective cooperation. When professionals entered face-to-face dialogues they were usually able to solve their communication problems which occurred frequently. In situations where communication took place via a documentation system the problems could not be solved directly through a discussion with the communication partner. Thus, in these "non-co-presence" situations communication problems could become serious obstacles for smooth and effective cooperation and could lead to breakdowns.
All members of the ward were full or praise for the newly developed MDT system. They thought that the idea was very good and indeed it was necessary to have such shared documents. However, they were not happy with the existing system.
The two extracts from the MDT sheets in figures 4 and 5 show some typical problems: not all columns are filled in, e.g. the achieved date is sometimes missing although the action has clearly been carried out. The back page of the MDT list (the "Care Pathway") contains the columns "Action" and "Referral" which were meant to be ticked to show whether the intervention is an action or a referral. However, in this example, some professionals left both columns blank or put names in them. Furthermore, the column title "Name" is not used in a standard way either. Some professionals record the author of the entry, others record the recipient. Short term and long term multidisciplinary goals were supposed to be recorded on the front page of the MDT but some of the entries for Mrs Smith's list are clearly referrals or actions belonging to the "Care Pathway".

2. Documentation plays a different role for doctors and nurses.

Documentation is much more a coordination tool for nurses than for doctors. The named nurse documents the daily care in the care plan which then serves as the basis for the nurse that takes over: "So when I complete the care plan, if I'm not on on a

[2] The MDT had been changed during my ethnographic studies. This example shows the new forms that were used for this patient.

particular day, a nurse can go to that care plan and say, right, I know all about this lady." (Senior staff nurse in an interview). Many nurses are responsible for the patient, i.e. the named nurse, the second responsible nurse, the night nurse, the team leader, and possibly other nurses; whereas there is only one senior house officer (SHO), one (senior) registrar, and one consultant responsible for the medical care of the patients. Doctors record their medical judgement but for them documentation serves much more as a memory aid. The nurses evaluate their care every day to assess whether the goals they set have been achieved. This is considered to be a requirement as evaluation of care must take place once every twenty-four hours. Doctors review their plan of treatment as well, but less frequently than the nurses. If the consultant provides input for the diagnosis or treatment of a certain patient, this prompts the ward doctor to review his or her decisions. Thus, doctors are less likely to review when they are solely responsible for the medical care. As many nurses share the care for a particular patient, the recording of evaluation is also a coordination tool.

3. Nurses and doctors have different attitudes towards document management.

It was observed that doctors were reluctant to fill in the forms in the MDT folder although the consultant encouraged them to do so. It was mostly the nurses who recorded in it. During the ward rounds the nurses wrote down some of the doctors' statements or requests in the MDT sheets and recorded the doctors as the authors.

4. Different linguistic styles are used by doctors and nurses.

There are major differences in both terminology and language use of doctors and nurses. Doctors use precise and short sentences whereas nurses use longer sentences and tend to explain their statements. Documentation reflects the spoken language and, therefore, different styles are used by doctors and nurses for documentation.

5. Doctors and nurses have different professional concerns.

Obviously, doctors and nurses talk about different issues concerning the same patient. Doctors and nurses work autonomously (within the limits of a shared plan of care). Their different aims, responsibilities, and practical concerns are reflected in their (verbal and written) utterances. For example, nurses will talk about the social background of a patient only when they speak to nurses. In an interview, a charge nurse said: "Doctors are only interested in social things if they are relevant for medical things. I tell them only if I think it is important for them." Another nurse agreed: "Medics tend to focus on medical things; nurses focus on medical, nursing, and social things."

Some misunderstandings and disagreements are due to the different pragmatic concerns. Thus, not only semantic (how does the professional interpret what (s)he sees?) but also pragmatic issues are related to the different perspectives and thus have to be considered for supporting cooperation between different healthcare professionals in general and cooperative document management in particular.

6. Doctors and nurses have different professional terminologies.

Doctors' and nurses' terminology is different which can lead to problems of understanding each other. For example, a nurse might use the term "pyrexial" whereas a doctor might say "febrile". In interviews with doctors and nurses it could be seen that both professionals use a different terminology when talking to a member of the other group. Experienced nurses and doctors have learned some of the relevant terms of each other's terminology but problems still occur. They are most frequent when

student nurses and SHOs talk to each other. Some examples for the different terms and phrases are:

- loose stools (nurse) – diarrhoea (doctor)
- hypocalcaemic (doctor) – calcium goes wrong (nurse)

7. There are different modes of communication.

Most of the communication between doctors and nurses takes place in the ward rounds. Here, all doctors covering the ward, the named nurse and one other nurse responsible for the patient talk about each patient. The other medium for interaction is a case conference where all information is exchanged that also concerns other professionals involved. If something is important it should be mentioned to others; it can be done verbally but it must be also written down (because it might be meant for someone not on duty, as a reminder etc.). This is the plan which is not always followed as can be seen in the example entries in figures 4 and 5. The referral to physiotherapy is not recorded but it has obviously taken place as the physiotherapist records her comments in the list.

2.4 Summary

This section was about the ethnographic investigations that were carried out on a Geriatric ward. These investigations focused on document management practices and common cooperation problems. It was discussed which particular ethnographic methods were used and why they were applied. An overview of the general work patterns on the Geriatric ward was given and some issues were presented that need to be considered for the design of computer systems supporting teamwork in this area.

Given the author's general interest in document management and in designing technological support for it, the MDT folder was of particular concern. Its potential for enhancing shared care by means of computer systems was clearly seen. Therefore, it was decided to develop a new approach to cooperative document management.

The key finding of the field work was that cooperative document management is important but that breakdowns in cooperation can occur due to underlying fundamental communication problems. As cooperative document management in healthcare deals with "non-co-presence" situations, effective communication is vital for smooth cooperation. Therefore, it is argued, that the design of systems supporting cooperative document management must address communication problems that can lead to breakdowns in cooperation. Merely presenting data in different ways (e.g. in different interfaces for doctors and nurses in cooperative document management systems) according to the different viewpoints will not overcome these problems and thus not be a sufficient answer to the findings of the field work. Rather, it is argued that fundamental problems that exist with respect to shared documentation in multidisciplinary healthcare need to be solved first before technical realisations can be applied.

The focus of the present work is on written communication. However, it was found to be very difficult to find out about communication problems in documentation systems. Therefore, face-to-face dialogues were also considered and analysed as they can show existing problems that will occur in some form in a written medium as well.

The findings of the ethnographic studies (especially the main finding that communication problems exist and can be critical for documentation tasks) prompted the author to look at current theories of communication to determine which theories could be useful in this context. Thus, rather than developing grounded theory (cf. Glaser and Strauss, 1967) the aim was to generate a theory based on the ethnographic

findings and on existing communication theories. In the next section, the two theories of communication used for this work will be introduced and the larger context in which the present work is based will be discussed.

3 Theoretical Background

Given the ethnographic findings, the decision was made to focus the work on the use of IT to enable more effective communication through improving the design of cooperative document management systems.
The ethnographic studies showed that fundamental communication problems exist between members of multidisciplinary healthcare teams, especially between doctors and nurses. These communication problems threaten effective cooperation and thus need to be considered for cooperative document management. Therefore, it was decided to look at established theories of communication to find out whether they can provide help for the analysis and classification of the problems observed.
Two obvious candidates of communication theories were Searle's Theory of Speech Acts and Habermas' Theory of Communicative Action. Both have been influential in the area of information systems. Both theories were found to be intuitively understandable and useful for the experienced problems in communication. Therefore, it was decided to use both theories for developing a framework for an analysis of interprofessional communication problems in healthcare. The theories are located within the so-called Language-Action Perspective which forms the theoretical foundation of this work. First the two theories of communication will be introduced.
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3.1 The Theory of Speech Acts

John Searle published the Theory of Speech Acts in 1969 (Searle, 1969). His aim was to show that "speaking a language is performing speech acts (…) in accordance with certain rules for the use of linguistic elements " (Searle, 1969, p.16) and to formulate these rules (Searle and Vanderveken, 1985). Searle argues that the minimal unit of an utterance is not a word or a sentence but a speech act. There are different types of speech acts: e.g. a **propositional act** which is the act of uttering words whereas an **illocutionary act** is a complete speech act, i.e. uttering words, predicating and referring in a particular mode, e.g. stating, requesting, promising etc.
Thus, the performance of an illocutionary act involves the performance of the underlying propositional act. The same propositional act can be performed in different illocutionary acts but a propositional act cannot be performed alone. For example, in the three following illocutionary acts the propositional act is that nurse Andrea takes the patient's blood pressure. This fact can be expressed as a statement, an order, or a wish; i.e. the same fact may be part of different illocutionary acts:

"Nurse Andrea takes the patient's blood pressure." (*statement*)
"Nurse Andrea, take the patient's blood pressure!" (*order*)
"I wish nurse Andrea would take the patient's blood pressure." (*wish*)

If two illocutionary acts have the same reference and predication, they express the same proposition but they might express them in different ways as in the examples above. Likewise, a certain type of illocutionary act can be related to different propositional act; e.g. "Have you already assessed the patient's activities of daily living?" and "Did the patient have a complex fracture of the femorial shaft three years ago?" are both questions but they have different contents.

Therefore, there are two distinct components of an illocutionary act: a **propositional content** and an **illocutionary force**. The propositional content describes what an utterance is about whereas the illocutionary force describes the way it is uttered. Taken together, both components provide the meaning of the utterance and both have to be known to understand the speech act. In this article, only complete speech acts, i.e. illocutionary acts, are considered. The term "speech act" is, therefore, used here as a synonym for the term "illocutionary act".

Not all speech acts are direct utterances. First of all, the performative verb is not always present. Rather than saying "I state that this patient suffers from dehydration." a doctor is more likely to say "This patient suffers from dehydration.". Other indirect speech acts include questions such as "Can you tell me the patient's mental test score?". The recipient is expected to respond by providing the score and not by merely replying "Yes." which is, strictly speaking, a correct answer to the utterance.

Each illocutionary act has got a "point" which characterises that particular type of speech act. For example, an assertion is about informing other people, a request is about getting the recipient to perform an action etc. This purpose of the act is called the illocutionary point. Searle classifies utterances according to the illocutionary point and proposes the following five classes of speech act:

- **Assertives** represent facts of the world of utterance or common experiences, e.g. reports or statements.
- **Directives** represent the speaker's[3] attempt to get the hearer to perform the action indicated in the propositional content, e.g. requests.
- **Commissives** represent the speaker's intention to perform the action indicated in the propositional content, e.g. promises.
- **Expressives** say something about the speaker's feelings or psychological attitudes regarding the state of affairs represented by the propositional content, e.g. apologies.
- **Declaratives** change the world through the utterance of the speech act. The speaker brings about the state of affairs represented by the propositional content solely by uttering the speech act, e.g. sentencing a prisoner or performing a marriage.

Illocutionary forces with the same illocutionary point can have different **degrees of strength**. For example, an order has a higher degree of strength than a request (both are directive illocutionary forces), and a diagnosis has a higher degree of strength than a statement (both are assertive illocutionary forces).

Searle argues that the illocutionary force imposes certain conditions on the propositional content of an utterance, i.e. what an utterance can be about. These conditions are called **propositional content conditions**. For example, a diagnosis is about medical issues, a report can only be about present or past events.

Preparatory conditions express a speaker's presuppositions when uttering a certain speech act. They have to be fulfilled for a non-defective performance of the speech act. For example, a speaker using any directive force presupposes that the hearer is capable of carrying out the requested action. Preparatory conditions can also be related to the propositional content. Most utterances presuppose the truth of certain propositions. For example, if a doctor asks a nurse to refer a patient to physiotherapy, the doctor presupposes that the patient needs this input; a nurse promising to feed a patient presupposes that the patient cannot eat herself or himself.

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[3] Although both Searle and Habermas talk about "speaker" and "hearer", their theories can be applied to written communication as well.

Each illocutionary act implies a **commitment** for either speaker or hearer. An assertive speech act commits the author to the belief in the statement, an expressive statement commits the speaker to the psychological state expressed, a declarative statement commits the speaker to both belief in his statement and intention to bring about the change. The most important forms of commitment occur in commissive and directive speech acts because these types of act deal directly with the coordination of actions and utterances between communication partners. Directives commit the hearer to carry out the action represented in the propositional content whereas commissives create a commitment for the speaker to carry out the action.

3.2 The Theory of Communicative Action

Jürgen Habermas published his Theory of Communicative Action in 1981 (Habermas, 1981). He takes Searle's theory as a starting point for his own theory reflecting his concerns with pragmatic aspects of language. Like Searle he argues that a speech act is the elementary unit of linguistic communication and that each speech act consists of an illocutionary force and a propositional content. The illocutionary force established the mode of communication between speaker and hearer and thus the pragmatic situation of the contents of the utterance. The propositional content established the relation between the utterance and the outside world. Habermas distinguishes between the external reality (the world of objects and events), internal reality (the speaker's own world of experiences), and normative reality (the world of norms and values). In an utterance a speaker is seen as communicating about the internal or external reality in the context of a given normative reality. Different types of utterances concern different realities. Using Searle's classification, it can be stated that by using assertive forces the speaker aims to utter statements about the real world and, therefore, these types of forces are related to the external reality. Expressive forces are related to the speaker's own world of feeling and attitudes and thus to the internal reality. Declarative, commissive, and directive forces are uttered against a given normative background and aim to influence events in the real world.
Habermas distinguishes three types of actions:

- **instrumental actions** which are material actions that follow technical rules; they have an effect on events and state of the world
- **strategic actions** which follow rational rules and try to influence a rational opponent in order to achieve personal success
- **communicative actions** where the motivation is a rationally grounded consensus between the communication partners.

In the following, we will refer to communicative action.
A central argument in Habermas' theory is that "we understand a speech act when we know what makes it acceptable" (Habermas, 1984, p.297). So what makes a speech act acceptable? It must satisfy conditions that enable a hearer to say "yes" to the speech act. These conditions are not specific to certain speaker-hearer pairs but are general for all possible actors uttering and hearing similar speech acts. Through the utterance of a speech act a speaker makes an offer to the hearer to accept the speech act and enter into a rationally grounded relationship. The basis for such relationship are rational agreements that can be negotiated, criticised, changed etc. No force or threats are used, everything is out in the open. Habermas concentrates on those conditions that motivate the hearer to accept the speech act offer, presupposing that the utterance is grammatically correct and that conditions for this particular type of speech act are fulfilled. Thus, Habermas implicitly presupposes that the preparatory and propositional content conditions (using Searle's terminology) are satisfied and

introduces further conditions of his own. A speech act can only be successful if the hearer says "yes" to certain validity claims raised by the speaker which are determined by the illocutionary force of the utterance.
From the viewpoint of a hearer, there are three levels of reacting to a speech act:

- The hearer understands the utterance, i.e. (s)he grasps the meaning of what is being said
- The hearer says yes or no to claims raised through the utterance of the speech act, i.e. (s)he accepts or rejects the speech act offer
- Following an agreement, the hearer accepts obligations and commitments arising from the speech act that are determined by social conventions for this utterance

Habermas argues that a speaker making an utterance makes four implicit **validity claim**s:

- that the utterance is **comprehensible** so that the hearer can understand the speaker;
- that the utterance is **true**, i.e. it represents a fact or a common experience, so that the hearer can share the speaker's knowledge;
- that the utterance is **truthful**, i.e. the speaker's intentions are expressed in a sincere way, so that the hearer can trust the speaker;
- that the utterance is **appropriate** in relation to a given normative context, values, or standards so that the hearer can agree with the speaker in these values.

The four validity claims can be seen as four areas where communication can break down and require reparative action:

- If the utterance is incomprehensible then the speaker must rephrase, explain, or translate it.
- If the truth of an utterance is challenged then the speaker must justify the utterance, e.g. by explaining it, supplying more information, pointing to common experiences etc.
- If the hearer challenges the speaker's truthfulness then the speaker's intentions are called into question. Communication can only continue if the speaker succeeds in restoring the trust, e.g. through acting consistently, assuring the hearer of the speaker's sincerity etc.
- If the appropriateness of an utterance is challenged then the hearer questions the speaker's right to perform the speech act, e.g. if a speaker's role does not entitle him or her to do so, if a speaker violates recognised values or acts contradictory to norms. These problems are usually solved by pointing to other (unproblematic) standards and norms, referring to common experiences, citing relevant literature or authorities etc.

3.3 The Language-Action Perspective

The broader context of the present work lies in the so-called Language-Action Perspective (LAP). LAP is based on Searle's and Habermas' theories and focuses on communication aspects in information systems.
LAP was first introduced in the field of information systems (IS) in 1980 by Flores and Ludlow (1980) who argued that human beings are fundamentally linguistic beings and act through language. It was argued that language is not only used for exchanging information as in reports, statements etc. but also to perform actions, e.g. promises, orders, declarations etc.

The conventional perspective on information systems stresses the contents of messages rather than the way they are exchanged (Lyytinen and Lehtinen, 1984). For example, data flow diagrams are used as primary design tools. Thus, the focus is on the form and structure of messages (Dignum and Dietz, 1997). In contrast, the Language-Action Perspective emphasises what people *do* while communicating, how language is used to create a common reality for all communication partners, and how their activities are coordinated through language. Here, the focus is on the pragmatic aspect of language, i.e. how language is used in particular contexts to achieve practical goals such as agreements or mutual understandings. This new approach argues that as social action is mediated through communication, the main role of an information system should be to support organisational communication (Schoop, 1998). LAP has since developed into a new paradigm for the design of computer systems.
There are a number of basic assumption underlying LAP (Lyytinen, 1985; Verharen, 1997), e.g.:

- The basic unit of communication is a speech act.
- Natural language sentences correspond to the performance of speech acts.
- The meaning of sentences can be revealed by specifying the speech acts that have been performed.
- Speech acts obey socially determined rules.
- Cooperative work is coordinated by the performance of language actions which are speech acts.

The early work on LAP is based on Searle's Theory of Speech Acts (Searle, 1969). As a result of criticism of the shortcomings of Searle's theory (e.g. Dietz and Widdershoven, 1991; Suchman, 1994), Habermas' Theory of Communicative Action (Habermas, 1981) is nowadays used in combination with Searle's theory as the philosophical foundation of LAP.

3.4 Some applications of the Language-Action Perspective

The Language-Action Perspective is not merely a philosophical framework but has stimulated the development of a number of methodologies and computer-based tools such as the Coordinator, SAMPO, DEMO.
The first application of LAP was the **Coordinator** (Flores et al., 1988; Winograd and Flores, 1986). Developed by Winograd and Flores, it was motivated by the observation that the mere application of technology in an office did not necessarily lead to more efficient work structures; indeed it sometimes created more problems than it solved. Winograd and Flores argued that a theoretical basis for the design of new systems was necessary to support office work in an effective way. They claimed that LAP could provide this basis and argued that teaching people linguistic theory would make them aware of their communication structures. Winograd and Flores exemplified their ideas for the Coordinator as one system supporting conversations in an office setting.
SAMPO is an acronym for **S**peech-**A**ct based information-analysis-**m**ethodology with com**p**uter aided t**o**ols and was developed around the same time as the Coordinator (Lyytinen and Lehtinen, 1984; Auramäki et al., 1988, 1992a, b). Based on speech act theory, illocutionary logic, and discourse analysis, it is a tool for modelling organisational discourses in an information system (which is seen as a network of speech acts determining the structure of organisational transactions and resulting commitments). Lyytinen and Lehtinen (1984) present a new conceptual view of an information system as a medium of storing commitments and reporting on their fulfilments. This

contrasts with the conventional view on IS paradigm as a “data storage paradigm” where the main emphasis is on the storage and processing of data and information.
DEMO stands for **D**ynamic **E**ssential **M**odelling of **O**rganizations and aims to provide a modelling method for effective business process redesign (Dietz, 1994a, b; van Reijswoud, 1996). DEMO is based largely on Habermas’ theory but also on Searle’s theory. DEMO proposes to view an organisation as a social system in which individuals behave in certain ways and influence each other through communication (van der Rijst, 1997).

3.5 Critiques of the Language-Action Perspective

The Language-Action Perspective has attracted much interest in the field of information system but also some critiques. We will present some important criticisms and will consider them in the remainder of this report.
LAP has been criticised from disciplines such as sociology, ethnography, philosophy, computer science, linguistics. Critiques often specifically concern Searle's theory but are also related to the more general use of the Language-Action Perspective for organisational communication.
There has been criticism from within the LAP community concerning the adequacy of Searle's theory for analysing human communication. As an example, Dietz and Widdershoven (1991) recount Habermas' criticism of Searle's theory and argue that Habermas' Theory of Communicative Action is superior. The critical points are illustrated using the Coordinator as an example of a system based solely on speech act theory; it is argued that the Coordinator has severe shortcomings due to the shortcomings of Searle's theory. The most significant drawback of Searle's theory is that it does not adequately consider what makes a speech act successful, i.e. Searle neglects validity claims. Consequently, the Coordinator is not able to state the success criteria for speech acts and it is not clear what mechanisms for communication and coordination the system supports. Moreover, since Searle does not consider a speaker’s orientation, there is no distinction between directives based on validity claims and those based on power claims. Thus, strategic action cannot be distinguished from communication action.
Dietz and Widdershoven then go on to say that these problems can be overcome by using Habermas' theory as it provides the success criteria of speech acts in terms of criticisable validity claims and provides a classification according to the dominant validity claim (cf. Habermas, 1981). The consequences for the design of communication support systems are then obvious: there must be a facility to negotiate validity claims and to discuss problematic claims. Furthermore, the propositional content must also be considered. The Coordinator is criticised for its aim to support coordination in stable environments with clear hierarchies where negotiation is not and should not be the priority.
Bowers (1992) has also made a critical attack on the Coordinator. He begins his critique with a more general attack on the notion of formal representation. He refers to the Coordinator as an example of a system in the area of computer-mediated communication which relies heavily on formal representation, for expressing networks of communication structures. Bowers discusses common justifications for developing and using formalisms. It is often claimed that formalisms make a task clearer and more efficient. They can provide some form of emancipation for the user as certain things are made explicit which gives the user control over these things or at least makes him or her aware of them. This is one of the intentions behind the Coordinator. However, it must also be seen that any formalisation includes the possibility of forc-

ing people to behave according to the representation. The aim of the Coordinator is to facilitate and support communication in distributed work environments. The question Bowers raises is whether there is a central point which can draw all distributed speech acts together to coordinate them. If so, then it is possible to have central power and to use it to influence others. The users that are being represented might not be aware of this fact and might not have access to the representation. Bower calls for formalisms that are decentralised and open to critical assessments for all users. One strategy to achieve this is to use participatory design.

One of the most prominent and challenging criticisms of the Language Action Perspective (LAP) comes from Suchman (1994) who refers to some of Bowers' arguments. She does not talk about formalisms in general but rather concentrates on speech act theory and the Coordinator as an exemplar of LAP applications. Her main argument is that using speech act theory for the development of computer-based communication systems enforces discipline and control and, therefore, oppresses the users. Suchman presents both LAP and especially the Coordinator as aiming to provide frameworks for representing and controlling normal communication practices.

Suchman comments that speech act theory proposes strict classifications that do not allow for individuality and creativity of communication partners and suggests that

> "Alternatively, we might embrace instead (…) an appreciation for and an engagement with the specificity, heterogeneity and practicality of organizational life." (Suchman, 1994, p.78)

The more concrete points she makes about the Coordinator are that, firstly, it concentrates on pairs of a speaker's utterance and a hearer's reaction rather than interactions between the two; secondly, that conversations are often indeterministic in that a speaker does not always know what (s)he means at the beginning of a dialogue but that the meaning and intentions emerge during the interactions with the hearer. This is not considered in the design of the Coordinator and, therefore, an unnatural structure is imposed. The intentions that are often implicit in normal interaction must be made explicit by the speakers in systems like the Coordinator.

Suchman argues that the machine can be used to warn of potential breakdowns or to keep track of actions, a mechanism which can be used by organisations for control so that oppressive organisational structures are enforced rather than loosened:

> "Rather than being a tool for the collaborative production of social action, in other words, THE COORDINATOR (...) is a tool for the reproduction of an established social order." (Suchman, 1994, p. 168)

Suchman (1987) argues that plans are not executable sets of actions but rather that actions are performed depending on circumstances in certain contexts and are only loosely related to any plans. Thus, if the application of speech act theory as in the Coordinator forces the user to act according to predefined plans it is oppressive and against natural behaviour.

A critical look at LAP from a linguistic perspective is provided by Allwood (1998). His conceptual criticism of Searle's and Austin's theories has many facets. Firstly, he comments that the theories cannot account for the multi-functionality of speech acts. For example, the statement "It is raining." could be a warning or an assertion, depending on the particular context. Furthermore, Allwood argues that common communicative functions such as feedback or turntaking cannot be expressed because there are no related English speech act verbs. This leads to his second point which is that Searle's classification is based on verbs rather than communicative functions. As a consequence, Searle's speech act taxonomy is not complete.

Furthermore, Allwood argues that Searle's speech act taxonomy does not consist of mutually exclusive categories. The speech act conditions that Searle proposes do not clearly separate what is general from what is particular for one act. For example, there are some conditions that make general statements about a class of acts, e.g. propositional content conditions, while others are valid for a particular act only, e.g. preparatory conditions. Allwood also argues that Searle's theory relies heavily on literal meaning which is problematic as literal meaning does not really exist; it is dependent on context. Finally, Allwood presents a perspectival criticism. He argues that the context is not sufficiently taken into account, especially any existing non-rational or non-intentional aspects of communication. Habermas does not deal with what he calls defective speech acts and Searle presupposes intentional conversations. Habermas makes no distinction between ethics and rationality which leads to an insufficient treatment of ethics.
Allwood calls for some changes to be made to the Theory of Speech Acts and its use in applications of the Language-Action Perspective. An alternative well-founded taxonomy with disjoint classes should be developed. Furthermore, ethical issues should be sufficiently taken into account.

4 Cooperative Document Management in Healthcare

The aim of the present work is to exploit the potential of information technology to create a new generation of (computer-based) cooperative document management systems that can help to avoid breakdowns in communication and cooperation.
The approach taken in this work is as follows. The ethnographic studies showed that fundamental communication problems exist between doctors and nurses. Merely presenting data in different ways (e.g. in different interfaces for doctors and nurses in shared computer systems) according to the different viewpoints will not overcome these problems and thus not be a sufficient answer to the key findings. Rather, it is the author's conviction that the design of computer-based cooperative document management systems requires a fundamental overhaul, in particular that a rigorous theoretical foundation is required that draws on theories of communication and is anchored in empirical evidence. The qualitative analysis of communication patterns in healthcare discussed in previous sections showed which particular problems occurred and how they could be explained. These findings together with the theoretical basis provided by the Language-Action Perspective can be seen as indicating those features of multidisciplinary communication an ideal CDMS would need to facilitate.
To provide a basis for the design of cooperative document management systems, a means for defining and articulating communication and cooperation structures as the underlying basis for interactions via documents is then required. To specify requirements in these terms, a framework of features will be presented that need to be considered for the design of effective systems for cooperative document management. Therefore, a transition from the ethnography to an abstraction must take place. The development of such a conceptual design basis forms the focus for the remainder of this work. The concepts show the analysis of the problems observed in the field work and the broader process of solving problems. Thus, they provide an abstraction from the richer environment of multidisciplinary healthcare onto general features of an ideal CDMS. The process of abstraction includes leaving behind some of the elements that the ethnographic studies identified. For example, the issue of power relations is only considered implicitly in this section.

The conceptual elements for the design of effective document management systems are shown in table 1.
The framework will now be introduced and illustrated using the following scenario:
A consultant asks a nurse to administer hypnotics and betablockers to a patient with hypertension.
Through the following presentation, the reader should bear in mind that the ultimate aim of the work is to use the framework as a basis for the design of cooperative document management systems. Much of the time the implications for design will be left implicit, although on occasion requirements will be made explicit and expressed with reference to an idealised CDMS.

Actors (authors and recipients)
Main task and primary interest of actors
Responsibilities and duties of actors
Domain specific illocutionary forces
Illocutionary forces for author-recipient combinations
Degree of strength of illocutionary forces
Medical knowledge of actors and propositional content
Terminological correspondences
Propositional content conditions
Preconditions
Validity claims
Commitments of actors
Date of document entries
Interactions between document entries

Table 1: Conceptual elements of the framework

4.1 Classification of authors and recipients

First of all, the possible actors in the cooperative document management system have to be specified. As mentioned before, the present work has concentrated on the professional groups of doctors and nurses as these are the main contributors to patient care. However, there are obviously many different subclasses of these groups and a more refined classification of possible authors and recipients is necessary in order to be able to specify the author and recipient of document entries in a detailed way. Table 2 shows some classes of these two groups of healthcare professionals.
In the example, the author is a consultant. The recipient is a senior staff nurse on day shift because only senior staff nurses are allowed to administer drugs, and hypnotics and betablockers are only administered during the day. Therefore, only this particular group of nurses is the recipient of the speech act; for all other groups of nurses it is irrelevant.

Classes of Nurses	Classes of Doctors
Sister	Consultant
Charge Nurse	Senior Registrar
Senior Staff Nurse	Registrar
Staff Nurse	Senior House Officer
Student Nurse	Ward Doctor
Team Leader	Doctor on Call
Nurse on Duty	Doctor Admitting Patient
Nurse on Night Shift	Doctor Prescribing Drugs
Nurse Doing Assessment	Doctor Doing Assessment
Nurse Giving IV Injections	Doctor Ordering Blood Test
Named Nurse	Doctor Ordering X-Ray
Nurse Preparing Discharge	Doctor Discharging Patient
District Nurse	Doctor Giving Diagnosis

Table 2: Some classes of nurses and doctors

4.2 Main task and primary interest

Two important concepts in the present approach deriving from the field work are the professionals' main task and the primary interest. Each professional group has a main task, which determines the primary interest. A doctor's main task is to give the diagnosis and decide upon a treatment plan and, therefore, (s)he is primarily interested in the patients' presenting complaints, the past medical history, drug history, family history etc. Nurses are primarily concerned with patients' needs while they are on the ward because their main task is caring for the patients. The main task and primary interest must be considered because they partly determine what the different professional groups will talk about when looking at the same patient, i.e. what can be said in the propositional content of their utterances.

For example, the consultant in the scenario might state that the patient suffers from hypertension, is obese, has a family history of myocardial infarctions whereas the nurse, looking at the same patient, might say that the patient is depressed, does not sleep well at night and needs assistance with washing and dressing because of breathlessness.

4.3 Responsibilities and duties

Closely related to the main task are the responsibilities and duties of each professional group. The professional role indicates which obligations arise for different groups. This is an issue relevant to the set of possible illocutionary forces for each professional group.

A nurse, for example, is responsible for administering drugs, assessing the patient's activities of daily living, referring a patient to speech therapy, and preparing the patient's discharge; whereas a doctor is responsible for giving the diagnosis, prescribing drugs, assessing the patient's medical state, ordering blood tests, transferring a patient etc. Therefore, “assess” is an illocutionary force that both groups use.

4.4 Classification of illocutionary forces

Searle's five categories of illocutionary forces are used for classifying forces in this work. However, a medically-oriented set of subcategories of illocutionary forces is necessary in order to be able to make statements about forces specific to healthcare.

The forces observed to be used can be classified according to Searle's general framework as shown in table 3. The following explains for some forces why they have been classified in that way and makes some general comments on the taxonomy.

Assertive	Commissive	Directive	Expressive	Declarative
assess	evaluate	investigate	Query	admit
diagnose	investigate	order	rule out	discharge
evaluate	review	refer	suspect	transfer
identify needs	set goal	request		
inform		prescribe		
observe				
record				

Table 3: Classification of illocutionary forces

Assertive forces

Assertive illocutionary forces have the word-to-world fit, i.e. they reflect utterances intended to represent states of affairs in the real world. The table lists seven such acts.

- Diagnose: Issuing a diagnosis means classifying and labelling the patient's disease. A diagnosis is a statement made by a healthcare professional who believes that the disease (s)he has given is actually the one the patient suffers from. However, a diagnosis does not change a patient's state of health and does not make the patient have the disease. Therefore, it is not a declarative speech act which has the double direction of fit ("changing the world by saying so") but an assertive act.
- Evaluate: Evaluating patient care and treatment implicitly includes two illocutionary forces, i.e. stating a patient's current state (assertive) and reviewing the planned interventions and goals and changing them if necessary (commissive). It appears in column one in the former sense.
- Identify needs: Nurses identify patients' needs during their assessment, i.e. they state the areas that are problematic and need to be considered in the daily care.
- Record: Recording statements (indirect communication) is telling someone else how things are (word-to-world fit).

Commissive forces

Commissive forces have the world-to-word fit, i.e. they intend to change the world so that it reflects the utterance. The table lists four commissive forces.

- Evaluate: As mentioned, "evaluate" contains both an assertive and a commissive element.
- Investigate: In healthcare, "investigate" can be a commissive or a directive speech act, depending on the recipient. Investigating, for example, the cause of a patient's fall or the home circumstances commits either the same or a different professional group to carry out the relevant actions.
- Review: If a treatment or a prescription is reviewed, then the author is committed to consider the patient's actual state in order to decide about any necessary changes in the plan of care and treatment and to give reasons for the decision. The process of reviewing is always carried out within one professional group; there are no requests to review a patient by members of different groups. Therefore, this illocutionary force is classified as a commissive act.
- Set goal: Nurses assess a patient's normal and altered states, identify the needs and then set appropriate goals they are committed to achieve while the patient

is on the ward. Thus, setting a goal is committing nurses to ensure that the states described will be achieved.

Directive forces

In addition to the general directive forces "order" (which indicates strategic action) and "request", there are three other specific directives for healthcare. We will discuss the forces of “refer” and “prescribe”.

- Refer: Referring a patient to another specialty means issuing a commitment for a member of that specialty to assess the patient.
- Prescribe: The force of prescribing used by doctors is a request usually for a nurse, sometimes for a doctor to administer the drugs prescribed[4].) .

Expressive forces

The process of classifying a patient's disease is usually one of exclusion (Hoffmann-La Roche and Urban&Schwarzenberg, 1987) and three expressive speech acts are involved. Possible diseases are queried and ruled out and the most likely disease is taken as a preliminary diagnosis. This process is represented by the phrases "We query disease x", "Disease x cannot be ruled out", or "Disease x is suspected".

- Rule out: The phrase "cannot be ruled out" is often used in medical documents to indicate that, on the one hand, the professional is aware of the possibility that the patient might have a certain disease but, on the other hand, that the professional cannot decide yet whether this is really the case. Further actions such as tests or examinations are necessary; they are driven by the author's assumption that the patient is probably not suffering from the disease that is to be ruled out. Thus, uttering the phrase "ruling out" means implicitly making an expressive speech act "It has to be investigated whether the patient has the disease or not but I do not think it is likely".
- Suspect: A suspicion in the medical sense is a speech act in which the professional expresses uncertainty about the state of affairs, i.e. making a preliminary diagnosis means implicitly making the (expressive) speech act "I suspect this disease but I am not certain whether the diagnosis is true". "Suspect" can be seen as the opposite of "ruling out". Here the author thinks that the patient is probably suffering from the suspected disease.
- Query: Querying a disease expresses even less certainty. Here, the professional has thought of the possibility of this disease but does not necessarily suspect it. "Query" is also used to put up a temporary list of possible alternative diagnoses. Note the difference between the healthcare term "query" and a query in everyday communication where it often represents a question. According to Searle, questions are directive speech acts (requests for answers). In this context, "query" represents a professional term in a specific context as described.

Many diseases can be suspected, ruled out, or queried during the process of specifying a diagnosis. In all three cases, the author does not believe that this is the disease the patient is suffering from. Therefore, these three illocutionary forces are classified not as assertive but as expressive speech acts.

Declarative forces

The table shows three declarative forces.

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[4] Note that this is specific to secondary healthcare. In primary healthcare, a prescription made by a doctor does not usually involve a nurse. In the ethnographic studies it was observed that nurses are allowed to administer all drugs. Thus, in the present work the force of prescription is taken as a directive made by a doctor to a nurse.

- Admit: By admitting a patient to a ward, the patient is taken under the responsibility of the ward solely through the speech act of admission. A patient can even be admitted to a ward before (s)he physically arrives there.
- Discharge: Discharging a patient means being no longer responsible for the patient.
- Transfer: Transferring a patient to another ward or hospital means transferring the responsibility to someone else.

These three acts are not mere statements or commissives but change the world (the patient is now one of ward X; the patient is no longer one of ward X; the patient is now one of a different ward Y) solely through their utterance.

4.5 Possible forces for author-recipient combinations

Table 3 shows a general classification of forces. However, some of these forces are only used by particular authors which is again determined by their professional roles and associated pragmatics. For example, the "identification of needs" concerns nursing needs only and is therefore specific to the nursing domain whereas "rule out" is only used by doctors. Therefore, the set of all possible forces for each professional group has to be specified. For example, the set of illocutionary forces used by nurses (denoted by IF_{Nurse}) and the set of those forces that doctors use (denoted by IF_{Doctor}) can be specified as follows.

IF_{Nurse}= {assess, evaluate, identify needs, inform, observe, record, investigate, review, set goal, refer, request}

IF_{Doctor}={assess, diagnose, evaluate, inform, observe, record, investigate, review, order, refer, request, prescribe, query, rule out, suspect, admit, discharge, transfer}

Furthermore, it must be made explicit which particular forces the professionals use in the context of certain recipients; this is again determined by the professional role. Table 4 shows some possible combinations of forces, author, and recipients. For example, an evaluation carried out by a nurse will only be passed on to a nurse whereas both doctor and nurse can be recipients of a request.

As in the example scenario, the author of an act of prescription is a doctor, the recipient is a nurse. The existing responsibilities and duties and power structures can be used to specify author-recipient combinations further. For example, only senior staff nurses are recipients of any act of prescription because only they are allowed to administer drugs, consultants can issues orders for (senior) registrars and SHOs but not vice versa.

Author	Illocutionary Force	Recipient
doctor	asses	doctor, nurse
nurse	assess	nurse, doctor
doctor	diagnose	doctor, nurse
doctor	evaluate	doctor
nurse	evaluate	nurse
doctor	record	doctor, nurse
nurse	record	nurse, doctor
doctor	review	doctor
nurse	review	nurse
nurse	set goal	nurse
doctor	order	doctor, nurse
doctor	refer	doctor
nurse	refer	nurse
doctor	request	doctor, nurse
nurse	request	nurse, doctor
doctor	prescribe	senior staff nurse
doctor	rule out	doctor
doctor	suspect	doctor
doctor	admit	doctor, nurse

Table 4: Combination of authors, illocutionary forces, and recipients

4.6 Degree of strength of illocutionary force

Searle and Vanderveken (1985) argue that forces in the same category can have a different degree of strength, e.g. an order has a higher degree of strength than a request. This notion can be applied to some of the forces classified as shown in table 3. Let us look at the two assertives "diagnose" and "inform". Both state facts about a patient but a diagnosis has a higher degree of strength than mere information because a diagnosis is taken as the basis for a plan of treatment and for medical and nursing interventions. An information does not necessarily lead to changes in the process of patient care. In contrast to Searle's arguments, it is argued here that the degree of strength does not only depend on the different forces but also on the author making the utterance and on the recipient. For example, a request made by a doctor (as in the example scenario) has a higher degree of strength for a nurse than a request made by a social worker. This refined version of the degree of strength can be used to help a recipient to rank requests made by different authors.

4.7 Medical knowledge and propositional content

The main task, primary interest, and the professional role determine what knowledge each professional group has about a certain aspect of the care process. Doctors' knowledge and nurses' knowledge overlap but neither is a subset of the other. Such medical knowledge is embodied in the propositional content of speech acts which in general describes what the act is about. Speech act theory and illocutionary logic treat the propositional content as a primitive (Searle and Vanderveken, 1985). However, formalisation of the propositional content is required in order to allow queries to be made about the contents of an utterance (e.g. "Has the patient had a chest x-ray?" or "What is the patient's medication?") and to enable basic comprehensibility problems to be addressed (see next section). This will also help to clarify questions like "What

do nurses really mean when they speak about stroke? What do doctors mean by this term?".

4.8 Terminological correspondences

Comprehensibility problems can occur on two levels: that of unknown terms, where the utterance cannot be interpreted by the recipient, or that of misinterpretations where the recipient's interpretation differs from the author's intended meaning. In routine interaction, comprehensibility problems are usually solved by rephrasing or translating. In written communication there is no possibility to employ these human problem-solving strategies and, therefore, even the most basic comprehensibility problems can lead to total breakdowns in communication and cooperation.

For example, if the nurse in the example scenario does not understand the term "hypnotics" and does not manage to find out what kind of drugs are meant, then she cannot do anything until she can communicate with the doctor and ask for clarification. There can be no guessing as healthcare is a sensitive area where communication and cooperation is necessary to ensure best patient care.

In order to address these problems it is clearly vital that a cooperative documentation system must provide mechanisms to support the translation of the propositional content according to each group's requirements if necessary in order to avoid breakdowns due to incomprehensibility. The need for such translation mechanisms is important given the prevalence of comprehensibility problems recorded by the empirical studies. These mechanisms will provide familiar terms of the recipient's own professional terminology rather than forcing cooperating participants to understand and use the terminology of their communication partners. The professional terminologies have been developed over time to fit each group's requirements; they are not necessarily useful for interaction between different professional groups. Therefore, it is argued here that the possibility of a basic translation process will enable the participants to express themselves in the best possible way (in their own terminology) and to understand the communication partner appropriately (by translating unfamiliar terms). The participants will thereby achieve greater autonomy and emancipation (Lyytinen and Hirschheim, 1989).

One possible point of criticism is that in reality comprehensibility problems are usually solved and such mechanisms will, therefore, not be necessary. This is true for experienced nurses and doctors who have learned over time to translate automatically when they talk to each other. In the interviews performed it was seen how the professionals switch their language (often subconsciously) when talking to the other group. Student nurses or staff nurses on the one hand and medical students or senior house officers on the other hand experience many comprehensibility problems. Therefore, it is argued that the possibility to translate basic terms or phrases can be helpful; in the end it is the professional who decides whether to use such support or not.

If translation is to be integral to a CDMS, it is vital that there are appropriate notational features for expressing such correspondences. However, translation between different (medical) terminologies is a major research topic in its own right and beyond the scope of this work. Furthermore, comprehensibility problems concern semantic issues whereas the strategic emphasis of this work is on the metalinguistic and pragmatic level where the validity claims of truth and appropriateness are based. A more limited aim of this work is thus adopted, namely to provide a simple notation for accommodating synonyms and characteristic phrases. Results from other areas will be accommodated as and when this work on translation matures. Some examples of translation work will be briefly described. Binsted et al. (1995); Cawsey et al. (1995)

for instance report on work explaining parts of the medical patient record to patients which includes translating from the medical terminology to that of the lay patients. Work within the GALEN project has included using a formal model of clinical terminology as an interlingua between different classification systems (Hardiker and Rector, 1998; Rector et al., 1998).
In the present approach, work has been carried out on the level of synonyms and characteristic phrases with different levels of detail where comprehensibility problems can be solved relatively easy. Examples include the following:

- MI (doctor) - heart attack (nurse)
- TIA (doctor) - mild stroke (nurse)
- fractured neck of femur (doctor) - broken hip (nurse)
- febrile (doctor) - pyrexial (nurse)
- analgesia (doctor) - painkiller (nurse)
- diuretic (doctor) - water tablets (nurse)
- decubitus (doctor) - pressure sore (nurse)
- myopic (doctor) - short-sighted (nurse)

In the example scenario the nurse might not understand the term "hypnotics" which is not part of the nursing terminology. She would use the nursing term "sleeping tablets".

4.9 Propositional content conditions

Speech act theory states that the illocutionary force imposes certain conditions on the propositional content (Searle and Vanderveken, 1985), e.g. a diagnosis is about medical issues. However, these conditions need to be refined for the present work because in many cases not only the force but also the author and recipient determine what can be expressed in the propositional content. For example, a report issued by a nurse for a nurse might contain medical, nursing, and social issues whereas, if the recipient is a doctor, it might contain only medical and nursing issues (cf. section 2.3).
Propositional content conditions are especially important to consider in relation to prestructured entries in a CDMS, rather than free text. The Coordinator, for example, consists of free text messages and structured illocutionary forces. It is possible to imagine other systems where content is entered using short phrases; propositional content conditions provide the basis for controlling what is entered and the composition of possible and sensible phrases which can be formed automatically into sentences. Examples for such systems can be found in the area of medical and nursing classifications .
In the example scenario of a prescription, propositional content conditions for such utterance restrict the contents to drugs.

4.10 Preconditions

Preconditions show the author's presuppositions when uttering a certain speech act, in this case making an entry in the cooperative document management system. Misunderstandings can be due to an author's (implicit) presuppositions if the recipient is not aware of them. Therefore, it is important to make preconditions explicit as the recipient might not agree with them and thus challenge their truth.
In the example, the consultant presupposes that the patient suffers from hypertension, a fact that the nurse might want to question.

4.11 Validity claims

A key idea in the present approach is to incorporate validity claims as introduced by Habermas. They are critical to the success of speech acts. Only if the recipient of a speech act says implicitly "yes" to all the claims raised can the speech act be seen as successful. The consideration of validity claims allows fruitful discursive communication rather than a hierarchically-based issuance of orders and mere obedience of orders. In Habermas' words, communicative action that is oriented towards mutual agreement is enabled rather than concentrating only on strategic action oriented towards personal success. Nevertheless, these two types of action can be distinguished and strategic action can also be dealt with, e.g. in orders issued by doctors to nurses where no discussion is possible. Thus, both communicative and strategic action are supported equivalently.

To allow only sensible challenges, first of all the relations between the validity claims and the components of a speech act, i.e. the illocutionary force and the propositional content, need to be considered.

An utterance can be incomprehensible because the propositional content is not understood by the recipient. This is a common communication problem. However, it is also possible to challenge the comprehensibility of the illocutionary force used in a speech act. Illocutionary forces are not always specified in communicative interaction which can lead to misunderstandings about which force the author meant to use when uttering a sentence. For example, a consultant in a case conference might utter the sentence "We need to make a mental test with the patient." which was meant as a request (i.e. a directive) for the SHO to make the test; whereas the SHO understands the utterance as a mere statement (i.e. an assertive). Therefore, the claim of comprehensibility is related to both the propositional content and the illocutionary force.

Questioning the truth of a statement means questioning whether the statements really represents a fact, a common experience etc. It is not possible to challenge the truth of an illocutionary force because questioning whether the author's intentions indicated by the illocutionary force are sincere is questioning the author's truthfulness. Thus, "truth" is related to the propositional content only.

The challenge of truthfulness is only related to the illocutionary force since the recipient doubts whether the author is really committed to the illocutionary force used when truthfulness is questioned. Here, the ostensible nature of the speech act is questioned, e.g. what seems to be an assertive act is really an attempt to deceive.

Both the illocutionary force and the propositional content can be inappropriate. However, a challenge of appropriateness concerns more often the illocutionary force than the propositional content. The recipient challenges the appropriateness of the illocutionary force used by the author by questioning whether the author is entitled to use this force in this particular context. The author could have violated existing power relations, recognised norms, or professional standards. A propositional content can also be inappropriate. Here, the recipient questions whether the sentence fits a given normative context, i.e. whether it is legitimate to say so.

To summarise, the validity claim "truth" is related to the propositional content whereas "truthfulness" concerns the illocutionary force only. Both "comprehensibility" and "appropriateness" can be challenged for the illocutionary force as well as for the propositional content.

Furthermore, the relations between particular speech acts and the validity claims must be examined (Schoop, 1997b; Schoop, 1998), e.g. a directive speech act can be incomprehensible or inappropriate but not false.

The relations between validity claims and the five types of speech acts used in this work are shown in table 5 which also includes the relations to the particular component of the speech act as discussed before[5]. Table 5 can be explained as follows. Comprehensibility problems can occur in all utterances. Habermas argues that all claims can be criticised for all types of speech act. The author does not agree with this notion as the claim of "truth" is not related to directive, commissive, expressive, and declarative speech act themselves but to their presuppositions. Therefore, the validity claim of truth is taken to be only related to the propositional content of assertive speech acts.
The recipient can always challenge the author's sincerity and thereby question the truthfulness of an utterance. A author might not believe in the statement (assertive) made, might not really promise (commissive) something, might not want the recipient to carry out the action as directed (directive), might not express real feelings (expressive), or might not be sincere when declaring a new fact (declarative). Thus, "truthfulness" is relevant for the illocutionary force of all types of utterances.
Appropriateness is related to assertive, directive, expressive, and declarative speech acts. For example, a statement or an expression of feelings can be inappropriate if the utterance in that particular context is against certain social norms. It is argued here that appropriateness is not related to commissive speech acts because a author can always commit himself or herself to carry out a certain action. There are certain presuppositions attached to commissive acts. For example, a promise presupposes that the recipient wants the author to do as promised. Thus, a recipient can challenge the truth of these presuppositions but this is not a challenge of appropriateness.
In the example scenario, a consultant asks a nurse to administer betablockers and hypnotics, which is a directive speech act. Using the classification of table 5, the following claims are relevant for this utterance: the utterance can be incomprehensible for the nurse as the recipient (i.e. challenge of comprehensibility), or the nurse can question whether the consultant is really entitled to ask her to administer the drugs (which would be a challenge of appropriateness). The nurse would also be able to challenge the truthfulness. However, it has never been observed in the ethnographic studies that such a challenge was ever made. Therefore, it was decided not to deal with the claim of truthfulness. The nurse cannot challenge the truth of this utterance but the truth of the presupposition, namely that the patient suffers from hypertension.

	Assertive		**Commissive**		**Directive**		**Expressive**		**Declarative**	
Validity Claim	**PC**	**IF**	**PC**	**IF**	**PC**	**IF**	**PC**	**IF**	**PC**	**IF**
Comprehensibility	+	+	+	+	+	+	+	+	+	+
Truth	+									
Truthfulness		+		+		+		+		+
Appropriateness	+	+			+	+	+	+	+	+

Table 5: Relations between validity claims and types of speech act

4.12 Commitments

All utterances create commitments for author or recipient (cf. section 3.1). As mentioned before, the most important forms of commitment occur in commissive and directive speech acts. Commissive and directive speech acts commit the author or recipient to carry out the action represented by the propositional content. However,

[5] PC stands for “Propositional Content”; IF stands for “Illocutionary Force”.

the recipient has the possibility to explicitly accept or reject such commitment. Only if the recipient accepts all claims raised in these types of speech act can the related commitment be accepted. The rejection of a commitment is based on a challenge of an underlying validity claim. Therefore, it must be possible to express commitments used in a cooperative document management system to indicate whether each commitment has been accepted, rejected, or not yet dealt with. If a commitment is rejected then the claim that has been challenged and the component of the utterance concerned (i.e. illocutionary force or propositional content) must be specified. Thus, the CDMS must provide mechanisms to deal with commitments in that way.
Commitments can be used for several purposes, e.g. as a reminder (the patient has yet to be referred to district nurses), control by the users themselves (which commitments are not fulfilled yet?), discourse (where does the cooperation between ward nurses and district nurses break down, what could be changed?), and for coordination of cooperation (referral to district nurses means that the district nurses have to take up the patient's care within three days).
In the example, a commitment is created by the directive speech act. If the nurse as the recipient accepts all the claims raised then she will accept the commitment to administer betablockers and hypnotics.

4.13 Date

The date of the issuance of the speech act must be recorded in a (cooperative) document management system. Thus, the framework must accommodate dates and times. In addition to the date of utterance, commissives and directives have a review date (which is the date given by the author up to which the action should be completed) and a so-called achieved date (which is the date when the act was actually carried out and thus the commitment was fulfilled).
In the example, the date of the request will be documented. Furthermore, the consultant will enter a review date (in this case usually the day the directive was issued) and the nurse will enter the date when the drugs have been administered for the first time.

4.14 Interactions with other speech acts

A speech act can trigger another act, it can be part of another speech act, or it can be a precondition for another act. These interactions with other speech acts need to be considered for particular speech acts. In general, explicit interactions can support the coordination of actions (e.g. a reminder that a particular speech act needs to be carried out as a result of another act), or they could be used for an automatic issuance of other acts [6].
In the example, the directive act to administer the drugs is the precondition for another act, namely that of ordering these drugs from pharmacy (which is again a directive act, this time with the nurse as author and the pharmacist as recipient). It is not a trigger of that act because the drugs might be available on the ward in the required quantity[7], in which case no drug order from pharmacy would have to be made.

[6] However, it is the author's opinion that the responsibilities should always remain with the human individual because this professional will be accountable for the actions in case of problems.
[7] Some drugs are stored on the ward. These are usually drugs that are used very often such as Paracetamol, Frusemide, or Senokot

4.15 Summary

In this report, the framework for cooperative documentation systems was introduced on a conceptual level. The elements that have to be considered for the design of useful CDMSs were introduced and it was discussed how they were informed by both the results of the ethnographic studies and the theoretical arguments of Searle's and Habermas' theories. It was shown how the two theories of communication can be combined for this work and necessary refinements for this work were introduced.

The classification of illocutionary forces does not produce a set of distinct classes. The force "evaluate" is classified both under assertive and commissive forces for reasons given above. Likewise, "investigate" is seen as either a commissive or a directive speech act, depending on the author's intention. It is felt that this is not a general problem of Searle's taxonomy but a specific problem of these forces. An evaluation consists really of two distinct (speech) acts which is why this force is classified in that way. It would perhaps be more effective to divide the force into these two actions and classify each of them. However, it was decided to use the illocutionary forces as they are used in healthcare.

The framework goes beyond purely linguistic features. The qualitative research in multidisciplinary healthcare showed that, for example, the professional role which determines the pragmatic concerns can explain some communication problems (Schoop, 1998). These findings are reflected in the conceptual elements. The framework considers, for example, the different professional roles of the communication partners (described by responsibilities, duties, main tasks etc.), their possible ways of communicating with each other which also indicate different pragmatic concerns (described by the classification of possible forces for each author-recipient pair, possible contents of document entries), and the underlying organisational structures and power hierarchies (authorisations for discussions, initiations of discourses or their prohibitions in case of strategic actions).

The framework enables new types of access to data in a system, not only to contents of data entries but, for example, also to all requests made by Dr. Smith, all unfulfilled commitments, all speech acts concerning a certain patient, particular illocutionary forces, particular propositional contents, particular authors and recipients, commitments fulfilled so far, commitments rejected because of false propositional contents, commitments rejected because of inappropriate illocutionary forces etc.

The general problem of Searle's theory is that it is author-focused. Suchman has criticised the Coordinator for having this characteristic. The present approach emphasises the interaction between author and recipient by incorporating Habermas' validity claims. This enables structured exchanges between two actors.

In the next section, we will present an evaluative discussion of the new approach to cooperative document management systems.

5 Evaluative Discussion

In this section, an illustrative evaluation of the approach presented in the report will be given as follows. A cooperative document management system will be simulated on paper and it will be shown how such a system could enhance document management and written communication in general between healthcare professionals. Three “example scenarios” will be considered for this purpose to show how real interactions would translate into the main conceptual categories as introduced before. These scenarios will illustrate interactions on a hypothetical healthcare environment based on the real hospital ward observed during the phase of qualitative research.

It will be shown that the new approach to document management in a multidisciplinary healthcare environment will contribute to enhanced interactions on the basis of shared documentation by providing the basis for better cooperative document management systems that promote effective written multidisciplinary communication.
First the conversational setting will be defined in terms of the elements of the framework as follows. In general, doctors and nurses are the principal actors in the system. The following three doctors and three nurses will be assumed to interact in the example scenarios. They are instances of the two general classes of actor and of the six specific groups of doctors and nurses. They act as authors and recipients of document entries.
To fulfil their main tasks, the different professionals are interested in certain information concerning the patient. As discussed in the previous section, these two elements are important for the possible contents of the medical utterances, i.e. together with the professional knowledge of each group of actors they determine what the professionals will document with respect to the patient. The primary interest and main task of each actor are specified as shown in table 7.

Actors		**Instances**
Doctor	Consultant	Brigid May-Ringer
	Registrar	Joe Briggs
	SHO	Maria Mitchum
Nurse	Charge Nurse	David Green
	Senior Staff Nurse	Megan Lilley
	Staff Nurse	George Friend

Table 6: Some actors in the CDMS

Actor	**Primary Interest**	**Main Task**
Doctor	patient's presenting complaint past medical history family history drug history	give diagnosis decide on treatment
Nurse	patient's nursing needs family background social circumstances community care input	care for patient

Table 7: Primary interest and main tasks of the actors in the CDMS

According to the professional procedures and standards, doctors and nurses are responsible for different acts. Table 8 shows some of them. Note that these are speech acts (e.g. prescribe drugs, assess incontinence state, refer to other professionals) as well as instrumental actions (e.g. administer drugs, take blood samples).

Actor	Responsibilities, Duties
Doctor	prescribe drugs
	assess medical state
	take blood
	Diagnose
	Discharge
	refer to doctors
	inform other professionals
Nurse	administer drugs
	assess continence state
	send blood samples
	prepare discharge
	refer to district nurses
	set goals
	inform other professionals

Table 8: Some responsibilities and duties of the actors in the CDMS

The actors interact in certain ways. This can be specified by the possible combinations of actors and illocutionary forces as shown in table 4. The responsibilities and duties as shown in the previous table help to determine which forces can be used by certain actors. For example, in table 8 it is stated that a doctor is responsible for assessing a patient's medical state and a nurse assesses a patient's continence state. Thus, both actors use the illocutionary force "assess". A doctor refers a patient to other doctors whereas a nurse is authorised to refer a patient to district nurses. Thus, a doctor is allowed to utter a speech act with the force "refer" to other doctors and a nurse is allowed to utter a referral to district nurses as shown in table 9.

Author	Illocutionary Force	Recipient
Doctor	accept	Doctor, Nurse
Nurse	accept	Doctor, Nurse
Doctor	agree	Doctor, Nurse
Nurse	agree	Nurse, Doctor
Doctor	assess	Doctor, Nurse
Nurse	assess	Nurse, Doctor
Doctor	diagnose	Doctor, Nurse
Doctor	inform	Doctor, Nurse
Nurse	inform	Nurse, Doctor
Doctor	prescribe	Charge Nurse, Sister, Senior Staff Nurse
Doctor	refer	Doctor
Nurse	refer	District Nurse
Doctor	request	Doctor, Nurse
Nurse	request	Nurse, Doctor
Named Nurse	set goal	Nurse

Table 9: Some possible combinations of actors in the CDMS and illocutionary forces

The illocutionary forces need to be classified according to the five categories of Searle's theory in order to enable statements about classes of utterances. For this example, only three classes of illocutionary forces are relevant, see table 10.

Assertive	**Directive**	**Commissive**
agree assess diagnose inform	prescribe refer request	accept set goal

Table 10: Classification of some illocutionary forces

The classification of forces determines which of the validity claims are relevant for a particular utterance. Each class of forces in this example, i.e. assertive, directive and commissive forces, is related to certain claims. This is shown in table 11 where "PC" stands for "propositional content", "IF" is used as an abbreviation for "illocutionary force", and "PR" represents "precondition".

	assess diagnose inform			**prescribe refer request**			**set goal**		
Validity Claim	**PC**	**IF**	**PR**	**PC**	**IF**	**PR**	**PC**	**IF**	**PR**
Comprehensibility	+	+		+	+		+	+	
Truth	+		+			+			+
Appropriateness	+	+		+	+				

Table 11: Relevant validity claims for different type of illocutionary forces

To enable a translation process, a list of synonyms of terms and characteristic phrases needs to be specified. Some simple examples are shown in table 12.

Synonyms	
Phrase Used by Nurses	**Phrase Used by Doctors**
drug preventing blood clotting	Anticoagulant
prompting	reminding to urinate or open bowels
sleeping tablets	hypnotics

Table 12: Some synonyms used by the actors in the CDMS

The author and recipient of a speech act and the illocutionary force used in it determine the propositional content conditions, i.e. these three elements limit the possible contents of utterances (cf. section 4.9). For example, a nurse will inform another nurse of nursing interventions, medical or social issues but only pass on medical or nursing issues to a doctor. Some examples of propositional content conditions are shown in table 13.

Author	Illocutionary Force	Recipient	Propositional Content
Doctor	prescribe	Nurse	drugs
Nurse	inform	Nurse	nursing interventions medical issues social issues
Nurse	inform	Doctor	medical issues nursing issues

Table 13: Some propositional content conditions

Given these definitions, it will now be shown how the interactions would be orchestrated, i.e. how a computer-based CDMS based on the description language would mediate the conversations. The concrete form of this system is not specified but the reader should imagine it being realised as a computerised on-line system perhaps with an interface similar to the format of present paper systems.

5.1 Scenario 1

Let us assume that the following interaction occurs.

> *Brigid May-Ringer uses the CDMS to request George Friend to arrange for a blood sample to be taken and sent to the lab regarding levels of anticoagulant within the next two days. George Friend indicates that he does not understand what anticoagulant means and asks the CDMS for clarification and receives it. George then agrees to do as requested. George asks Maria Mitchum to take the patient's blood within the next two days. Maria agrees and takes a blood sample the next day. George asks Megan Lilley to send the blood sample to the lab which she does the same day the sample has been taken.*

It will now be considered how and why these interactions are enabled by the CDMS. There are three speech acts in this interaction which will now be analysed.

The **first speech act** is a request made by Brigid May-Ringer to George Friend. Table 6 shows that Brigid is a doctor and more specifically a consultant, George is a staff nurse. The CDMS looks up the possible combinations of actors and forces in table 9 where it states that a doctor can utter a request with a nurse as hearer. Therefore, the CDMS allows this act as valid. The illocutionary force used has been classified as a directive speech act (see table 10) and the CDMS therefore allows George to consider the following validity claims. Comprehensibility and appropriateness are related to both parts of this utterance (i.e. illocutionary force and propositional content) and the claim of "truth" concerns the presupposition. Brigid will be required by the CDMS to make the presupposition explicit so that George can decide whether he agrees. In this case she presupposes that the patient suffers from TIA. The CDMS ensures the comprehensibility of the illocutionary force by making the force used explicit, i.e. request. Appropriateness of the force is likewise ensured by only allowing the speaker to use forces that have been specified beforehand (for this example in table 9.

George now indicates to the CDMS that he cannot understand the term "anticoagulant" that Brigid has used. The CDMS allows this challenge of comprehensibility of the propositional content because it is valid for this type of utterance according to the definition in table 11. The translation process provides the nursing phrase "drug preventing blood clotting" as a synonym, see table 12. Now George understands the utterance and decides that he finds it appropriate. George thereby accepts the commitment to arrange for the sample to be taken and sent to the lab which is classified as a commissive speech act (see table 10). Brigid has been prompted to give the

review date which she specifies as four days later. The review date for George's commissive speech act would be the same date as Brigid's review date.
George now issues the second speech act. It is a request for Maria Mitchum to take the blood. Maria has been specified in the CDMS as an SHO (table 6) and a request made by a nurse to a doctor is a valid act (specified in table 9) and thus allowed by the CDMS. The validity claims associated with this type of speech act have been described above. Maria does not have any problems with this utterance and accepts the commitment to take the blood sample which is a commissive speech act. George has recorded that the action needs to be carried out within two days. After Maria has taken the blood the day after George requested it (thus within the time limit he gave), she documents the achieved date in the CDMS.
Now the third speech act can commence. This is a request made by SN Friend to Megan Lilley to send the blood sample to the lab. The CDMS allows this request because Megan is a senior staff nurse (see table 6) and requests by nurses to other nurses have been specified as authorised speech acts in table 9. George needs to record the review date which he gives as the current date. Megan accepts this commitment and sends the sample off straightaway. She records the achieved date. George can then record this date as the achieved date for the first speech act and thereby ends his commitment.

5.2 Scenario 2

The second example of the language in action is based on a scenario discussed in section 4.

> *Joe Briggs prescribes hypnotics and betablockers for a patient with hypertension and wants a nurse to administer these drugs on the same day. He specifies the presupposition that the patient suffers from hypertension. Megan Lilley does not agree with this statement and indicates this to the CDMS which presents this challenge to Joe. Joe explains why he wants Megan to administer the drugs and justifies the diagnosis of hypertension. Having read these explanations, Megan now agrees to do as requested.*

Joe is a registrar on the ward (see table 6). He is allowed to use the force "prescribe" with some nurses as hearers as indicated in table 9. Originally, Joe wanted to ask George Friend to administer these drugs but he is only allowed to choose between David Green or Megan Lilley because only sisters, charge nurses, or senior staff nurses are allowed to administer drugs and, therefore, only these actors are legitimate hearers of an act of prescription. Thus, the CDMS does not allow SN Friend to be the recipient for this request. With SSN Lilley as the hearer it is a valid act. The propositional content condition for an act of prescription limits the content to drugs as shown in table 13. Joe as the hearer is prompted by the CDMS to make his presupposition explicit which in this case is the diagnosis for the patient, i.e. that the patient suffers from hypertension.
In table 10 it has been shown that the act of prescribing is a directive. The legitimate validity claims for directive speech acts are comprehensibility and appropriateness for both parts of the speech act (as specified in table 11); both appropriateness and comprehensibility of the illocutionary force are automatically ensured by the CDMS. The claim of truth is not related to this type of act but truth is always related to the preconditions of any speech act. SSN Lilley can now consider whether the propositional content of the utterance is comprehensible and appropriate. Let us assume that the utterance as it stands is not comprehensible; comprehensibility must be achieved

before the hearer can decide on the appropriateness of an utterance. The nurse wants to clarify the term "hypnotics" which nurses do not usually use and asks the CDMS for clarification. The translation process in the CDMS then provides the nursing term "sleeping tablets". Now Megan indicates that she does not think that the patient suffers from hypertension. Thus, she challenges the truth of the presupposition made by the doctor, which is a valid challenge and therefore allowed by the CDMS.
She is prompted for her reasons, e.g. "The patient does not have high blood pressure. I have measured his bp for the last three days and it has always been normal". The CDMS will then present the challenge to Dr. Briggs who has the option to accept the challenge or to rebut it. In this example, he does not agree with the nurse's statement and, therefore, answers with a rejoinder: "Patient suffers from hypertension, measured bp this morning 170/100, normal for last days only because he was on drugs, now change in drugs because they caused sleeplessness in interaction with other medication". This answer is presented to Megan who now agrees and thus accepts the commitment to administer the drugs. Joe wants Megan to start with the course of drugs on the same day and thus records the current date as the review date. Megan administers the drugs later that day and records the achieved date.

5.3 Scenario 3

The last example is based on experiences on the real ward.

> *Brigid May-Ringer asks George Friend via the CDMS to make an incontinence assessment for a certain patient. Her presupposition is made explicit in the CDMS, namely that the patient is incontinent of faeces. George indicates to the CDMS that he does not agree. He states that the patient is not incontinent but needs prompting and suffers from diarrhoea. Brigid does not understand the word prompting and asks the CDMS for clarification. When she receives it she explains her statement that the patient suffers from incontinence. George then suggests an alternative course of action, namely to prescribe Loperamide and see whether this solves the problem, which Brigid accepts.*

The two actors are again consultant Dr. Brigid May-Ringer and SN George Friend (as specified in table 6). The first speech act is a request made by Brigid for George to assess the patient's state of continence. The classification of a request and the related validity claims have been discussed in the first scenario. In this example, the nurse challenges the truth of the doctor's presupposition that the patient is incontinent of faeces. The CDMS allows this challenge as a valid reply to the doctor's request and George must specify the reasons: "I don't think the patient is incontinent. He only needs prompting. I think he has diarrhoea." Brigid is presented with this challenge by the CDMS. She wants to clarify the term "prompting" first which will be translated into the medical phrase "reminded to urinate or open bowels". As she now understands George's reasons she replies by stating again that the patient is incontinent: "Patient suffers from stress incontinence, under control on ward because nurses remind the patient to go to the toilet". The CDMS will present this answer to George who decides to suggest a compromise: "Why don't you write him up for Loperamide and see whether his loose stools become better. If this does not work we can make an assessment then." The CDMS presents this to Brigid who now agrees on this new course of action and thus on the rejection of the original request. Therefore, the original request is marked as cancelled.

The second speech act is a new request with opposite roles of the actors, i.e. George as the speaker and Brigid as the hearer, which is allowed by the CDMS according to the predefined authorised interactions in table 9. George is then required to give a review date which would be the current date in this example. Brigid will record the achieved date if she accepts the related validity claims that George raises, which she does. Thus, she has committed herself to prescribe Loperamide.

5.4 Discussion

The first scenario in this section reconsiders a situation experienced during the field work where it was an example for a complete cooperation breakdown due to existing problems. These problems were only resolved in the face-to-face dialogue that took place after a considerable time. In the current practice (of which the scenarios in the previous section are examples), documentation is a purely passive medium prone to breakdowns which cannot easily be resolved. Note the contrast to the role of documentation as a true medium for communication/cooperation as proposed here. A CDMS based on the framework would avoid the breakdown by making the hearer of the speech act explicit, as shown in the first scenario in this section. This would make the doctor aware that (s)he was meant to take the blood.

The focus on validity claims is of particular importance as it enables the participants to enter discussions and negotiations towards mutual agreements. As demonstrated in the scenarios, CDMSs based on this approach would make challenges to validity claims explicit and indeed pre-empt them in the case of incomprehensible or inappropriate acts by making the illocutionary forces explicit and allowing only forces that have been defined as appropriate to be used by a particular speaker. Furthermore, a CDMS would make it possible for the communication partners to enter a discussion rather than having to wait until the communication partner is present which is the current practice. If a challenge occurs, this means that a communication problem exists. However, the speaker is made aware of it and can react through the CDMS. Thus, cooperation is less likely to break down compared to the present situation.

A key difference between a new CDMS as discussed here and the current practice is that the whole process of the discussion is mediated and, therefore, recorded by the CDMS which can help other professionals for their own decision making. For example, the history behind the agreements in scenarios 2 and 3 could be seen by other professionals if required. Scenario 3 shows that the outcome of a discussion does not need to be the acceptance of the commitment intended by the speaker. In this case, the hearer did not agree and made a counteroffer which was then accepted by the speaker. Thus, the original request would be marked as rejected but it would still exist in the system so that the professionals could access it if necessary. Scenario 1 shows that the mediation of conversations can be difficult due to the complexities of such interactions. For example, the three speech acts discussed in the scenario are all interrelated and the system must recognise that they all belong to the same conversation even if there are other speech acts with the same speaker or hearer occurring in between the three utterances.

In section 4 I argued that IT can help to support cooperative work in non-co-presence situations. Documentation as a medium for written communication is one example of such situations. However, technology can never solve all existing problems between human actors. For example, it would not be possible to enhance the following problematic situation through the introduction of computer technology: a doctor recorded a request in the medical notes and expected the nurse as the recipient to look in there and carry out the requested action. The nurse did not know of this request and

would not be able to find it either. No element of my framework could prevent this mismatch. Furthermore, nurses complained that doctors were reluctant to document in the cooperative system (which was also observed during the ethnographic work, see section 2.4), a problem which cannot be solved by the present work.

Whilst the benefits of the CDMS are clear this is not to ignore the potential difficulties when it comes to implementing working CDMSs. The ethnographic work indicated that some communication problems were due to ambiguous speech acts. In applications based on the framework, certain features that were implicitly used before must be made explicit. By making communication more explicit (i.e. who is meant, which force is used etc.), it is believed that many breakdowns in communication can be avoided. However, it is possible that a user might regard this as more disturbing than helpful. Therefore, a computer-based CDMS will have to have a carefully designed user interface to acquire the necessary data without requiring more effort of time and work for the user compared to existing systems. For example, it is possible to classify utterances automatically into the five classes (assertive, commissive, directive, expressive, declarative) through the illocutionary force used provided that the problem of multiple classifications has been solved.

Suchman (1994) has criticised the Coordinator for requiring users to make parts of an utterance explicit. She argued that this can be problematic because a speaker does not always know what (s)he means at the beginning of an interaction. I would argue that this might be the case in everyday interaction but this is not very relevant for organisational communication in the case of multidisciplinary conversations in a healthcare setting. It has not been observed that the problems with implicit utterances concerned the speaker's problems of uttering what (s)he meant; rather the speaker thought the utterance was clear for the hearer who did not understand it as was intended to, e.g. what was meant as a directive was understood as a mere statement.

It is a well-known claim for the development of computer-based systems that the advantages of existing paper-based systems should be retained while exploiting the benefits that computer-based systems can offer . Whilst this is a relevant consideration in this context, I would argue that not only should the advantages of paper and computer technology be combined but paper should not necessarily be abandoned in favour of IT. For the context of multidisciplinary healthcare, it is not envisaged by this work to create a paperless hospital, not even to create paperless documentation . It is believed that paper documents will always play a role in cooperative work in healthcare. Even if documentation was completely computer-based, some paper documents would still exist. For example, most of the nurses observed during the field work wrote on small pieces of paper what they wanted to remember, to tell the other nurse during the hand over, or what they wanted to document later on. Likewise, doctors sometimes wrote down results during an examination on some scrap paper before recording the results in the medical record.

It is also important to emphasise that it is not proposed to eliminate face-to-face communication which forms an important part of routine interaction. Nor is it proposed to force such types of communication into a documentation system. Rather, the aim is to use CDMSs to make written communication more effective, to strengthen the true role of documentation as a medium for supporting cooperative work through effective written communication.

Not all elements of the framework need to be implemented to have a positive impact on written communication. However, I would argue that even if all elements were implemented, the result would be less rigid compared to systems such as the Coordinator because this work addresses interactions between two actors rather than

being focused on an author of an entry in the CDMS. Furthermore, through the incorporation of validity issues, discussion is encouraged and the hearer is given the possibility to criticise an utterance in a structured way. Finally, by including the possibility of a "free shot" through a charity relation which gives each actor the possibility to ask for a favour without being in the position to request it, it is acknowledged that there are situations that cannot or should not be structured but rather left to the actors to decide on an appropriate response. Another point worth mentioning is that this work presupposes the existing social structure in multidisciplinary healthcare. In this sense, the established social order is reproduced and the actors are forced to comply to this structure, a fact that both Suchman and Bowers have been critical about in their works. The author concedes that her goal was not to change the organisational structures but to enhance interactions within them. It is not believed that a system that dissolves the organisational and power structures would succeed in such a highly hierarchical domain as healthcare. However, this work could provide the possibility for social change. In this section, table 9 showed a fixed definition of authorised illocutionary forces for each actor in the system. Another possibility would be to give and retract authorisations between communication partners dynamically (Verharen, 1997), i.e. the partners themselves could negotiate these authorisations. This could lead to the establishment of new social structures. For example, nurses could be allowed to prescribe certain drugs, doctors could relinquish their right to order nurses to perform actions etc.

6 Conclusion

6.1 Summary

This article has introduced a Language-Action approach to cooperative document management systems. In particular, the development of a formal framework for the design of such systems to promote effective written communication in multidisciplinary healthcare has been proposed and discussed.

The approach taken for this work started with a general interest in how computer support could enhance multidisciplinary cooperation in healthcare, especially documentation for both doctors and nurses. To find out about general work practices, communication and cooperation patterns, documentation practices, and common causes of problems between doctors and nurses, ethnographic studies were carried out on a Geriatric ward. At the end of these studies which lasted for several months, it was decided to concentrate on providing a theoretical basis for the design of better cooperative document management systems that help to avoid communication and cooperation breakdowns. The reasons for this were threefold:

- It was found that for the cooperation between doctors and nurses, information technology could be helpful in non-co-presence situations because in such situations, the existing problems were observed to have the potential for causing complete breakdowns in communication and cooperation. When the communication partners were co-present, problems occurred but could usually be solved in face-to-face dialogues. Documentation is the main form of a non-co-presence situation and it plays an important role in healthcare.
- The cooperative aspect that is so important in multidisciplinary work is stressed in cooperative document management systems. The staff of the geriatric ward who developed the MDT system were enthusiastic about it and

it became apparent that the development of CDMSs would be a worthwhile form of computer-supported cooperative work

- At the same time, it was observed that there were existing problems with this form of written communication which justified a new approach to the development of CDMSs. It was decided to exploit the potential of information technology to make CDMSs more effective.

The central phenomenon that threatened effective cooperation was problematic communication occurring between doctors and nurses. It was found that these problems needed to be solved first before a computer-based CDMS could be introduced for efficient cooperation. This finding prompted an examination of existing communication theories for developing a theoretical framework to explain the problems that had been observed in a structured way. Habermas' Theory of Communicative Action (Habermas, 1981) was looked at because his ideas have been quite influential in the area of information systems. Habermas' arguments of validity issues seemed like a revelation; it was found that the problems could indeed be classified according to the underlying validity challenges. However, there were problems of cooperation for which Habermas' theory did not seem sufficient. Here the researcher turned to Searle's Theory of Speech Acts and again found some useful concepts. The two theories were combined into a framework which was tested out in the field by recording communication scenarios and analysing them with the framework. It was established which concepts from both theories are relevant for the area of interest, i.e. multidisciplinary healthcare.

After establishing a classification of common communication and cooperation problems, the next step was to think about how breakdowns in written communication could be avoided, thus to think about features of an ideal CDMS. A framework for the design of such idealised CDMSs was developed that could accommodate these features and describe those aspects of multidisciplinary healthcare necessary to promote more effective document management. During this process, Searle's and Habermas' arguments were revisited and it was established that some of them needed refinement for the purposes of this work. For example, it was found that not only the illocutionary force but also the identity of the author and recipient of a certain speech act determined what could be expressed in the propositional content.

It has been illustrated how the framework could be used by simulating an operational CDMS based on the language. This initial evaluation used scenarios based on the ethnographic work to show how interaction would be enhanced by dealing with communication problems in a structured way and thereby preventing most breakdowns.

6.2 Revisiting the key findings of the ethnographic work

In section 2.3 the key issues resulting from the ethnographic findings were discussed. It was argued that they need to be considered for the design of any computer-based systems supporting cooperative work, CDMSs in particular. In this section I will discuss how these issues were addressed in the present approach and will elaborate further implications as they arise. The issues are highlighted in italics.

The first finding was that *cooperative document management is important but breakdowns can occur*. The main philosophy behind this work is that cooperative document management is not only important but indeed vital for effective cooperation. However, cooperation does not always work. Cooperative document management systems must take into account potential breakdowns in communication and seek to ameliorate them. That is what this work is all about.

The *different pragmatic concerns* have influenced the development of the framework in many ways. The professional role has been considered through the specification of the main task, responsibilities, and duties of each professional group. The different pragmatics are also reflected in the utterances of professionals which is the reason for including the medical knowledge in the language to enable a specification of what the professionals say or write to each other.
The *different linguistic styles* used by doctors and nurses and their *different professional terminologies* were the motivation for working towards a translation process to back up the interaction between doctors and nurses when they think it necessary. I have argued that for a CDMS to promote effective communication in multidisciplinary healthcare, the existing communication and cooperation problems have to be addressed in a theoretically rigorous way rather than attempting to address the different viewpoints of professionals by merely providing different presentations of patient data. Nevertheless, I would suggest that the latter approach can also be helpful once the theoretical basis for the design of CDMSs has been developed as in this work. Thus, different interfaces for the different professionals according to their requirements of access and data representation could address the different linguistic styles used by doctors and nurses, and provide the relevant information in their own professional terminologies.
The finding that *documentation plays a different role for doctors and nurses* which also explains their *different attitudes towards document management* is something that has not explicitly been addressed here. I believe that technology can never solve all existing problems between human actors. Some problems will remain, such as problems resulting from the different attitudes, and need to be addressed in a different way. If people do not want to cooperate then this cannot be enforced. Interpersonal relations must be dealt with elsewhere.
It is possible to implicitly address these problems, e.g. by making elements like unfulfilled commitments explicit. For example, if doctors repeatedly fail to take blood samples although it had been requested by nurses, then this could initiate a different *mode of communication* such as discourse. The aim here is not to support this type of interaction by the system because it is not felt necessary and best dealt with on a face-to-face basis. Documentation is mostly used for asynchronous processes, e.g. a nurse asks a doctor to look at a patient's pressure sores which the doctor will usually not do at the same time the request is documented. However, one general advantage of computer-based systems, i.e. availability, can also be exploited for synchronous remote processes, e.g. a nurse documents a certain request in the cooperative document management system on the ward while a doctor looks at X-rays at the same time in the X-ray department and documents the diagnosis that the patient suffers from a fractured femur.

6.3 Future work

Further work can be carried out in the following areas: evaluation, prototype design, and application to other domains. An initial evaluation of the framework was presented in section 5. Further work is required to perform a more rigorous evaluation. Further evaluations could be carried out through experiments in which nurses and doctors would be presented with hypothetical patient cases and asked to interact through the CDMS.
A natural continuation of the work would be to develop further the prototype of a computer-based cooperative document management system based on the framework to evaluate further how such an operational system would enhance written communi-

cation. A decision on candidate architectures would have to be made. The CDMS could be realised as a client-server architecture where nurses and doctors access shared data resources that would be presented according to their different information requirements. To this end, alternative interfaces for nurses and doctors would have to be designed to represent these requirements with respect to presentation, access, and retrieval of information. Context would have to be represented according to the specific viewpoints, e.g. what information is relevant for present decisions, how are responsibilities handled etc. This CDMS could either contain all features of the framework, it could contain some, or it could be implemented using the framework elements as an informal guide for considering important issues in multidisciplinary healthcare.

The present approach could be applied to other areas involving multidisciplinary work with documentation or indeed to other areas where the general findings could be helpful. For example, (Te'eni and Schwartz, 1998) have used the present work for their analysis of communication in an international cooperative work environment; Currel et al. (1998) have used the theoretical framework for analysing communication problems between doctors and nurses (Schoop, 1997a; Schoop, 1997b) in their research into information use and information needs in nursing. The framework is currently being adapted to document management in an electronic commerce context.

6.4 Contributions

I would argue that the present research makes a number of specific contributions that are discussed below. The ethnographic work provides a good understanding of multidisciplinary work practices and group work. There has been hardly any study of doctor-nurse interaction; (Fafchamps, 1988) is an exception and reports on communication in a surgical intensive ward. Many studies in the area of healthcare have either concentrated on doctor-patient discourse or cooperation within one professional group; for example, Heath and Luff (1996); Luff et al. (1992) talk about paper documentation to support cooperation between doctors. Multidisciplinary cooperation is at least as important as interaction within one group. In healthcare this kind of cooperation takes place mainly between doctors and nurses as the main contributors to patient care. Therefore, an ethnographic investigation into cooperation and its problems between doctors and nurses is a contribution in its own right.

Empirical studies using the Language-Action Perspective (LAP) have not frequently been done before. Although there has been much theoretical work in the LAP community, the practical modelling has usually not been based on empirical data. I would argue that by basing the approach on a solid empirical platform, many of the criticisms that have been made of LAP have been reassessed and overcome. Suchman's criticism that the categories and classifications of organisational behaviour are imposed from the outside rather than coming from the users of systems themselves (Suchman, 1994) is clearly avoided here. The classification of communication problems emerged during the ethnographic studies and was further refined using concepts from Searle's and Habermas' theories. The aim of ethnography is to present situations from the participants' own points of view rather than forcing the researcher's own categories on the data.

On the theoretical side, I have refined both Searle's and Habermas' theories for the present purposes. My notion of an illocutionary force is different from Searle's in that I have shown that the categories he presents are not only dependent on the force (as he argues) but also on the speaker or hearer of the utterance. Habermas' theory was slightly amended with respect to the relation between validity claims and certain types

of utterances. I discussed my opinion that the claim of "truth" is not related to all utterances as Habermas argues.
Contrary to (Dietz and Widdershoven, 1991), I do not see the two theories as contradictory. Rather I would argue that they consider different aspects of speech. Searle describes different types of utterances and classifies them. Furthermore, general characteristics of a speech act are established and their different values are discussed for the different types of speech act. Therefore, Searle describes conditions for ideal communication. Habermas, on the other hand, develops a framework for the process of achieving consensus through negotiating validity claims that are imminent in each utterance. He takes into account that communication problems can occur and describes the mechanism for achieving mutual agreements in human interaction. Therefore, the two theories can be integrated to provide a powerful framework for communication analysis.
The Language-Action paradigm focuses mainly on the pragmatic and metalinguistic level which means that comprehensibility problems are often ignored. It has been argued in the present approach that comprehensibility problems need to be addressed in this context because they are the most common communication problem in doctor-nurse interactions. Therefore, the possibility of providing translation between different professional terminologies has been proposed. The aim is to bring in results from other approaches dealing with similar issues, e.g. explaining the medical record to patients or mapping between different medical classification systems. Thereby I aimed at drawing together the semantic level dealt with in these other approaches and the pragmatic level of the Language-Action Perspective.
The main contribution of this research is that it provides a systematic theoretical framework for the design of CDMSs. The categories introduced as elements of the framework show which features of multidisciplinary communication are salient and need to be considered for the design of CDMSs that will help to avoid breakdowns in communication and, therefore, enable better cooperation. It has never been claimed that this work could help to solve all communication problems but it is argued that most breakdowns can be avoided. This will make possible CDMSs that promote more effective multidisciplinary communication. Since the focus of the present work was interaction rather than one particular healthcare group, better systems will be enabled that are useful for and usable by all professionals involved. As cooperation problems are always to the disadvantage of the patient, this work is expected to contribute to improved patient care by making smooth cooperation easier. It is important to stress that this is not the only way to improve written communication. Another possibility could be to teach professionals to improve their communication skills.
The benefits of the Language-Action approach have been demonstrated for the example of multidisciplinary healthcare. It can also be expected that the framework developed here can be applied to other multiprofessional settings involving documentation management systems. The categories that have been introduced are not specific to the domain of healthcare but can be used to describe any communication setting by specifying:

- the possible actors in the system (classification of authors and recipients),
- their different professional roles (described by responsibilities, duties, main tasks etc.),
- their possible ways of communicating with certain other actors (classification of possible forces for each author-recipient pair, possible contents of utterances),

- the underlying organisational structures and power hierarchies (authorisations for discussions, initiations of discourses or their prohibitions in case of strategic action) etc.

The issue of misunderstandings due to different professional terminologies (which is considered by the translation process) can be a general problem if professionals from different disciplines work together. Hence, the results of this work are expected to be generalisable.

To summarise, I have argued that this work will contribute to enhanced cooperation in healthcare by providing the basis for better CDMSs that promote effective written multidisciplinary communication.

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