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# The impact of ICT on communication in Healthcare

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**Abstract**

*Communication processes are pervasive in the daily practice of health professionals. Reorganizing these daily practices by introducing ICT, inevitably effects one or more communication processes. Understanding exactly what these effects are, is a major problem in designing and implementing ICT-applications. In this paper we present an analysis of these effects, based on a theory of communication processes. The concept of 'decoupling' is pivotal in our analysis. Based on the identified effects, and some preconditions that have to be met in order for these effects to take place, we derive a number of guidelines for reorganizing communication processes by means of applying ICT. The application of these quidelines will be demonstrated and discussed in the context of the reorganization of a team conference at the Rehabilitation Clinic of the Rheumatology Department of the Leiden University Medical Center (RCRD/LUMC).*

***Keywords:***

Systems Analysis, Interdisciplinary Communication, Telecommunications.

## Introduction

Healthcare is highly collaborative in nature. Healthcare professionals are involved in, what Clark [1] calls, joint activities most of the time. With respect to these joint activities, Clark [1, p.29] makes two important observations, that are worth quoting here: "Two or more people cannot carry out a joint activity without communicating...", and "Language use and joint activity are inseparable". This explains why the 'communication space' is so vast, and why the quality of communication is so important for the quality of care (see Coiera [2] for relevant empirical data).

Most applications of Information and Communication Technology (ICT) within health care aim at the enhancement of collaborative work. The electronic medical record is a clear example, although it is more often encountered as a mere datastore than a coordination device [3]. What exactly can ICT offer? In order to answer this question, we have to take a step back along the lines of Winograd and Flores [4, p.7]. They approach this question from the premise that: ICT is "...a technology that operates in a domain of language", and that understanding the impact should focus on "...the role it will play in mediating and facilitating linguistic action...". So, thinking through this premise, and taking into account the observations put forward by Clark, we can conclude that ICT-applications directly affect the communication that takes place in the context of joint activities. As a result these joint activities will be affected also, but only in an indirect fashion. This conclusion underpins the proposition that communication should be the, or at least a major, focal point in medical informatics research, as put forward in [2], [5] and [6].

In this paper we will address two questions that follow from this conclusion:

1. Which features of a communication process are affected by ICT, and in what way, and
2. How does this affect the quality of the communication process?

In the next section we present a model for communication processes, based on communication science literature. We then, in a following section, discuss the way ICT can change the features highlighted in the model proposed, and its impact on the communication quality. These considerations will give rise to a small number of reorganisation guidelines, which are illustrated by the discussion of a reorganisation of a team conference at the rheumatic rehabilitation clinic of the Leiden University Medical Center.

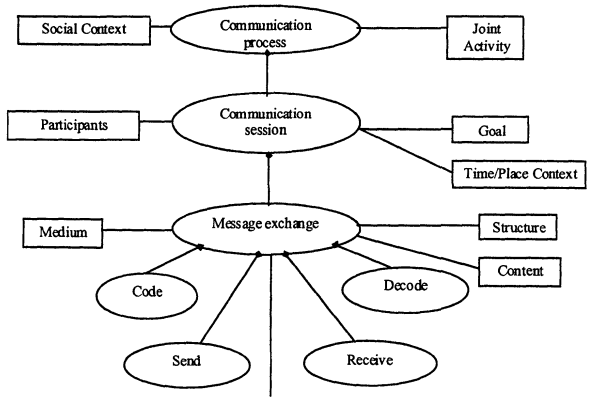


*Figure 1 - Decomposition of communication process*

## A model for communication

In this section we will briefly describe a model for communication processes. It is based on [1] and [7]. In order to find out

which features are relevant for describing communication processes, we start with decomposing a communication process into its constituting activities. In Figure 1 we present the result of this step.

A communication process, that is related to a joint activity, can be decomposed into one or more communication sessions. Such a session has a specific goal (e.g. the sender wants to inform receivers about a current state of affairs), and it takes place in a specific time/place context (at 10 AM in a meeting room). As part of such a session one or more messages are exchanged between participants using some kind of medium. In each case a message is coded, sent, received and decoded.

We can characterize a communication process by describing the following elements and their features:

- **Joint Activity**: the joint activity has three important features. The first is its ***analyzability***. A joint activity is highly analyzable when it can be decomposed into an ordered set of steps. The second feature is its ***variety***. Variety is low when all instances of the joint activity are similar. Clark [1, p.31] comprises these two features into one dimension, that he refers to as 'scripted vs. unscripted'. The third important feature is the ***urgency*** of the joint activity.
- **Goal**: we distinguish six main goals (see also [8]): agree on condition of the patient; inform; chose a treatment plan; formulate and coordinate interdependent actions; order; manage relationships.
- **Time/place context**: there are four possibilities: same time/same place; same time/different place; different time/same place; different time/different place.
- **Participants**: two features are important here. First of all the ***number*** of participants. Secondly, what we will call the ***size of the common ground***. If participants share a lot of background knowledge, their common ground is large. If not, their common ground is small. Clark elaborates the concept of common ground extensively. It is related to the concept of cognitive distance used by Te'eni [7].
- **Social Context**: Joint activities require joint commitments [1, p. 289]. Achieving these joint commitments can be difficult. Clark [1, Ch. 10] distinguishes three types of social contexts. The first type he refers to as ***closed***. In this situation participants have clear roles, and associated responsibilities. These roles do not have to be negotiated, as part of reaching a joint commitment. A physician ordering a nurse to administer some drug, is an example of a ***closed*** situation. In ***regular*** situations, the second type, most roles and responsibilities are clearly allocated, but some allocations must still be negiotiated. A team conference, as will be discussed later on, is an example of such a situation. The third type is called ***open***. In such a situation roles and responsibilities must be negotiated. This is the most difficult situation for reaching joint commitment. The concept of social context presented by Clark is related to the concept of affective context discussed in [7].
- **Message**: a message has an explicit ***structure*** or not. And its ***content*** can be more or less predictable or not.
- **Medium**: the medium used to exchange messages has a high ***capacity***, in that it can accomodate different modes of information, or not. Its ***evanescence*** is either high or low. For example, face-to-face communication has a high evanescence, while paper based communication has a low evanescence. Finally, its ***simultaneity*** is either high or low, that is: participants can produce and receive messages at once and simultaneously [1, p.9].

In the section on the reorganization of a team conference, we will demonstrate how a specific communication process can be described using these elements and features.

## The impact of ICT

As noted above, we will base our analysis on the premise proposed by Winograd and Flores, that ICT-applications are linguistic artefacts. So, their main impact will be on the communication process taking place in the context of a joint activity. The overall effect of this impact can best be referred to as ***decoupling***. ICT-applications enable participants, in principle, to chose different values for the communication process features.

Decoupling can be achieved with respect to most features distinguished in our model. We will discuss those types of decoupling that most frequently occur, and are also most prominent in the case study we will present.

- **Time/place context of session**: This is the most common, and wellknown, type of decoupling. For example, when people use e-mail instead of a face-to-face contact for communicating, each can decide for himself at what time and from which location to participate in the communication process.
- **Structure of message**: participants can prefer different message structures to accomodate their work. ICT-applications can transform structures. For example, a diagnosis is entered as a code into an electronic medical record by a physician, and read by another physician as a (set of) terms. The transformation of the code into the set of terms is done by the medical record application.
- **Content of message**: participants can even use different message content, due to the processing possibilities of computers. For example, a nurse enters both size and weight into an electronic medical record, and a physician reads the automatically computed Quetelet Index.

The main benefit of decoupling from an organizational point of view, is that participants in a joint activity become less interdependent. This enables them to organize their part of the joint activity, and the other activities they are involved in, more efficiently. However, decoupling should not decrease the quality of the communication, because that would lead to misunderstandings and a possible decrease of the effectivity of the joint activity. Te'eni [7] presents an extensive discussion on quality assessment. In [6] his model is applied to the team conference that we will also discuss here as a case study.

For the purpose of this paper, we are mainly interested in the question what the effect is of decoupling by means of ICT on communication quality. Based on the work of Clark and Te'eni we can formulate two guidelines that state which requirements have to be met in order to decouple by means of ICT, without decreasing the quality of communication.

3. Decoupling on ***time/place context*** requires a joint activity that has a ***closed*** or ***regular*** social context. In the case of a ***regular*** social context, we have to look for sessions that are devoted to allocating roles and responsibilities. These are the sessions that do not have ***inform*** or ***order*** as goal. Such sessions often require intimate and multimodal interaction between participants, and must not be decoupled on time and place.
4. Decoupling on ***message structure*** and/or ***message content*** requires explicitly structured messages and computable transformations. These requirements can only be met, without decreasing the quality of communication, in the context of ***highly analyzable*** joint activities with ***low variety***.

These guidelines can be used in reorganizing communication processes by means of ICT. This will be illustrated in the next section.

## Reorganizing a team conference

Team conferences at the RCRD/LUMC, in which different health professionals concerning the multidisciplinary treatment of patients participate, play a crucial role in formulating and adapting rehabilitation goals, planning and evaluating actions. These weekly conferences, that take 1,5 hour, are scheduled and attended by all disciplines of the rehabilitation team. The chair of these conferences is the medical doctor of the team.

During team conferences two tasks have to be performed: (1) Exchange of information about patient health status, as formulated by different health professionals, (2) Formulating of and finding agreement about team goals to be set, and evaluation which guides further team actions. During this process discipline specific information (i.e. information that is gathered and will be used by one discipline only) has to be translated into team information (i.e. information that is of use for all disciplines involved).

From the literature ([8], [9]) and daily practice it appeared that staff satisfaction with team conferences where no overt structuring of tasks 1 and 2 is used, is generally low. The main problems with these team conferences can be summarized as:

1. A lot of time is spent on informing other disciplines, without significant interaction taking place.
2. Common goals are hardly ever formulated. Treatment goals are often discipline specific.
3. If common goals are formulated, they are not systematically evaluated at follow-up conferences.

Literature ([8], and [10]) shows evidence that structuring the tasks, by using a Rehabilitation Activities Profile (RAP)-TEAM structure as proposed by [11], has positive effects on staff satisfaction. So, introducing a RAP-TEAM structure was one of the interventions proposed. Along with that we looked for ways of introducing ICT as a supporting technology for the team conferences.

The following structure can be used to characterize the pre RAP-TEAM structure and ICT organization.

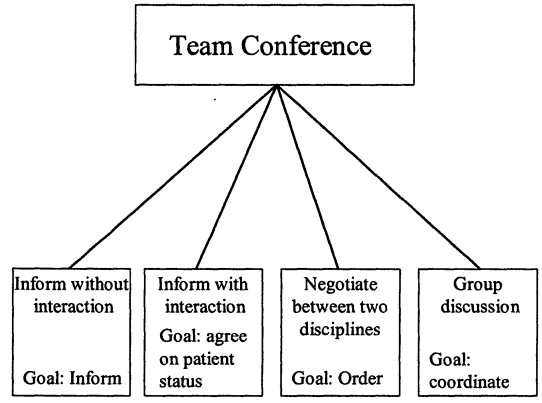


*Figure 2 - Current team conference structure*

The team conference at the RCRD/LUMC can be characterized as a rather well analyzable joint activity which has a low variety. The social context is regular. Over the years a specific structure has emerged, where the physician starts a patient discussion, by relating his or her findings and treatment results. After that all other disciplines provide their findings, one after the other (**inform without interaction**). In the case of misunderstandings or new information, questions are asked or extra information is provided (**inform with interaction**). Sometimes, two disciplines enter in an order-accept interaction (**negotiate between two disciplines**). After all disciplines have provided their information, the physician gives a brief summary, and initiates a discussion about the future actions to be taken (**group discussion**).

The current organization offers possibilities for decoupling without decreasing communication quality. Given the guidelines stated above, we can decouple on message structure and content for all the sessions, and we can decouple on time and place for the sessions ***inform without interaction*** and ***negotiate between two disciplines***.

The new situation can be summarized as:

1. Before the team conference all the disciplines fill in an electronic form, containing a set of items relevant for assessing the condition of the patient. Different disciplines fill in different items, so, in a way, each sender composes his own specific message, with respect to structure as well as content.
2. Before the team conference each team member receives a printed summary of the combination of all forms filled in. So, receivers work with different messages than the ones that were sent, due to the combining and summarizing work done by the information system.
3. Negotiating between two disciplines is done outside of the team conference.

4. The new team conference consists of only two instead of four session types: **inform with interaction**, and **group discussion**.

The design of the form referred to in point 1 is based on the RAP, described in [11].

## Discussion

The new organization of the team conference has been operational for a number of months now. Based on video material of the old situation and the new situation, an empirical study will be performed to the effects of introducing the RAP-TEAM structure and the ICT-application, on quality indicators of the communication process and staff satisfaction. The main hypothesis that will be tested is that communication quality is not decreased and that staff satisfaction will be increased. Empirical results will be available mid 2004.

We have stated in our introduction that the impact of ICT-applications is on the communication process. The impact on the joint activity, in the context of which this communication process takes place, is only indirect. However, ICT-applications are often evaluated with respect to their impact on joint activities. In the case study presented here, it is tempting to evaluate the impact of the ICT-based reorganisation with respect to the effect it has on the quality of care provided. For example, can we observe a significant increase in patient satisfaction in the new situation? Although this is an important question, we want to stress once again that the only quality ICT-applications can influence is the quality of communication processes. The relation between the quality of communication processes in health care and their associated joint activities can only be established by further research, and doing this is one of our objectives for the coming years.

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