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Chapter XVI

Using Communication Norms in Socio–technical Systems

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ABSTRACT

Often socio-technical systems are designed simply on the basis of what the user asks, and without considering explicitly whether the required process structure is right and wrong. However, poor communication may cause many problems. Therefore, a design cycle should always include diagnosis, and in order to be systematic, the (process) diagnosis should be model-based and driven by explicit communication norms. Such a diagnosis process is outlined and illustrated with a case from a financial service process. Furthermore, it is shown that recognition of universal communication norms can also improve tool design and quality management of socio-technical systems in general.

On the other hand, in a society whose communication component is becoming more prominent day by day, both as a reality and as an issue, it is clear that language assumes a new importance.

—Jean-Francois Lyotard

INTRODUCTION

Traditionally, designers of information systems often follow a “waiter strategy”. That is, they collect requirements from the customer, and build a system that meets these requirements. However, what if the customer asks for a wrong system, a system that arguably will cause trouble in the form

of misunderstandings, inefficiencies and failures? So designers have learned to be a bit cautious: do not take the wishes of the users and the current ways of working at face value. However, what are the criteria that we should apply then? Is it just intuition based on experience? In this chapter, we suggest another more systematic way.

Before doing that, we first recall that today's Internet-age information systems are much more communication than computation systems. They include not only workflow management systems and enterprise resource systems, but also applications that support complex communication processes, like discussion and group decision making, and many kinds of collaborative work such as group authoring, often not under the control of one single organization. It is becoming increasingly essential to view the technical systems as being embedded in a social context, to consider the socio-technical system as a whole, including the people and their relationships.

In order to deal with these new requirements, Ronald Stamper has argued that we need to move away from the traditional information *flow* paradigm, in which positivistic modelling aimed at producing automated solutions is central. Instead, an *information field* paradigm is needed (Stamper, 2000). At the core of this paradigm are fields of norms. Norms bind groups of people together. Shared norms constitute what is called the "social reality"—something not given once for all, but constantly in the process of being redefined and renegotiated. Note that "norm" should not be interpreted in the narrow sense of laws or ethical rules imposed by some society or institution. A norm is any rule (mostly implicit) that we apply in our daily practice and that we expect others to apply. Often, but not always, they have a rationale: not following the norm has some undesirable outcome. There are several kinds of norms: how to behave in a certain situation, how to interpret a certain term, how to draw conclusions; etc.. Some norms are context-specific; some are more general or even universal.

This chapter focuses on an important subgroup of norms that can be characterized as "communication norms", for the obvious reason that these are the norms most relevant to communication systems. We are specifically interested in general norms that can provide guidance in process diagnosis and design. What exactly falls under the heading

"communication norm" will become more clear when we move on.

Norms are to be distinguished from goals (Mylopoulos, Chung, Yu, 1999). A goal is a certain state that a stakeholder wants to reach or to maintain, whereas a norm corresponds to a shared expectation. A goal is usually specific to a certain time and a certain context, whereas norms tend to have a universal character (although the weight given to the norm may differ from one context to another; and there are also particular norms). For example, profitability is an economic norm in the market; to increase sales of our company by 20% next year, is a goal.

In (Weigand, De Moor, 2003), a certain list of general communication norms was presented based on an analysis of workflow models in the Language/Action Perspective (LAP—cf. Winograd, Flores, 1986; Denning, Medina-Mora, 1995; Dietz, 2005). For example, a communication norm is that organizational actors should commit explicitly to a request, or decline explicitly. If not, the requester and the executor may easily have different expectations with disappointments as a result. Some more norms on the way communication processes are realized by means of signs between actors are analyzed in (Weigand, De Moor, 2007).

The objective of this chapter is to show why it is recommendable to apply communication norms explicitly in process diagnosis, quality management and group system design, and how to do it. The aim is not to present a list of specific norms (we refer to the publications mentioned above for a proposal), but to show their use.

Our view on diagnosis is that it is an essential step in the design cycle. It cannot be replaced by just collecting requirements. In certain design approaches—evolutionary development in particular—diagnosis is even the most important step. These approaches are very suspicious of design projects aimed at reaching an abstract desired situation rather than solving a concrete problem. Indeed, such projects tend to have a high failure rate.

PROCESS DIAGNOSIS USING COMMUNICATION NORMS

How can communication norms be used in diagnosing workflow processes? Let us look at a business case that we have analyzed a few years ago.

Business Case

The business case considers the settlement of mortgage finance within a Dutch banking organization. A diagnosis of the communication in this process was performed within several local offices. An elaborate description of this diagnosis can be found in (Poll, 2002).

Our case starts with a customer initiating a request for a mortgage contract. The interviews revealed that several scenarios are possible, of which we will present one as an example. For a good understanding of the example, the reader should know that the mortgage selling process is handled by local offices, but some of the administrative tasks have been delegated to a central service center geographically located at another place. The internal communication process at the service center falls outside the scope of this example.

A customer initiates a request for a mortgage contract by delivering a signed tender to a bank employee. In this case the delivery occurs by sending the signed tender per post to the local office. When a tender comes in, it is registered by a commercial assistant into a workflow management system. The purpose of this registration is to report reception of a request for a mortgage contract. Furthermore this serves as a means of control for the office manager. Before a promise is made to the customer to deliver a mortgage contract, the commercial assistant has to check for any missing items that are necessary for further processing. If items like an employer's certificate or health certificate are missing in the customer file, the commercial assistant will draw up a letter of thanks, saying that a mortgage contract will be drawn up as soon as the local office receives the missing items, thereby stating a conditional promise.

When all missing items have been delivered, the commercial assistant will request the service center to process the tender data and draw up a mortgage contract for the customer. This request is done through an automated mortgage system. The tender data will then be visible for a service center employee. According to the agreements between local office and service center, the commercial assistant talks with one service center employee and vice versa. So the data needs to be made visible to that specific service center employee. At the same time the commercial assistant will deliver the physical customer file to the administrative support department of his local office. The administrative support department is responsible for the settlement of the mortgage finance within the rest of the mortgage finance process at the local office.

Before the contract is drawn up the service center employee will report the date of signing obtained from the notary, to the commercial assistant at the local office.

Two days before the actual signing of the contract the service center employee sends a letter to the commercial assistant, stating the amount of money that needs to be transferred to the specified mortgage account.

In this particular scenario, somewhere in this time period the administrative assistant of the local office needs to know when the signing of the mortgage contract occurs and which amount of money needs to be transferred, because he/she is responsible for settling this matter within the banks local administration. In this case the only thing the administrative assistant can use as a trigger for action is the notification of the signing date send by the service center. In this case we assume that the commercial assistant is 'smart enough' to forward this notification to the administration department, so that the administrative assistant knows when the signing takes place. One day before signing occurs a request for information is made to the service center about the amount that has to be transferred, after a decline a request is made to the commercial assistant who delivered the customer file. The letter stating the transfer amount is then handed over or sent per post to the administrative assistant.

A Framework for Diagnosis

Figure 1 shows a framework for diagnosis. Typically, diagnosis starts after complaints have been raised, but it may also be part of a regular evaluation in which complaints are revealed. A complaint expresses a certain problem, where a problem is defined as a gap between the factual and desirable situation. What is a desirable cannot be determined without taking the norms of the stakeholders into account. A problem means a norm violation to at least one stakeholder. The identification of the norms and the norm violations (that is, problems) is represented at the bottom tier of the framework.

When analysts try to address user complaints directly, there is a risk that only the symptoms are treated, rather than the underlying causes. For that reason, proper diagnosis should be model-based. The goal of this model-based diagnosis is to find core problems; that is, problems (gaps between factual situation and what is desired) that at least partially have a causal effect on the problems that we start with. The core problems, being problems, are also

norm violations. So we have norm violations at the complaint level and at the core problem level. In the present context, we focus on one important class of norms at core problem level: communication norms. The model-based diagnosis is represented at the middle tier of the framework.

It is characteristic of norms in organizations, and in groups in general, that they are often implicit and evolve over time, whether it is to avoid confrontations, to foster dynamic evolution of the group, or whatever. As a consequence, the identification of norms often means making them explicit for the first time, which can be a delicate social process.

The diagnosis process starts at the bottom level with the recording and analysis of complaints. If the discovered problems warrant further attention, the model-based diagnosis starts with data collection, using interviews or other techniques, such as direct observation. A coding scheme needs to be in place like the one used in (Te'eni, 2000) that can be of guidance to the data collection.

The first step at this level is schematic *representation* of the data. Its objective is not understanding,

Figure 1. A multiple-level framework for diagnosis

but faithful recording of the process as it carried out, and as there are usually many ways it can be carried out, it is necessary to set up several schema's representing different actual scenarios and points of view. It is important that the schema technique does not introduce too much abstraction, since it must be an accurate picture of the 'as-is' situation. This means that techniques like Action Workflow (see below) will not be suitable for use at this stage, because the structure and level of abstraction they impose on the collected data are too high.

The third step is interpretation. For example, a certain message from A to B is interpreted as a request. For Te'eni, interpretation has to do with taking the actors into account as intentional beings. In terms of (Dietz, 2005), interpretation means moving from a data level to a communication level. Although it is possible to detect certain pathologies without interpretation, many communication problems can only be identified after interpretation. Action Workflow (Denning, Medina-Mora, 1995) provides useful modeling techniques for the interpretation step. It should be noted that the aim of the interpretation is not an exhaustive description of the communication acts, but only on those aspects that are crucial to the diagnosis process.

The next step is model *verification*. In this step, the quality of the current process is assessed using general communication norms such as the ones listed in (Weigand, De Moor, 2003).

The fifth step is the *comparison* of the 'as-is' description with existing "ought" models (procedures). This comparison is useful and may reveal that these models can be improved, or that they are ok but should be communicated or implemented better. Of particular interest is the question why the "as is" deviates from the "ought"; this has usually to do with some tension in the organization that may be due to internal evolutions or changes in the environment. For that reason, simply restoring the "as is" situation to comply with the "ought" is not always the best reaction. If we may draw a comparison with medical diagnosis, a medical doctor would not recommend a certain therapy or medicine without having asked what cures the patient has been

following or is currently following, and assessing their effect or lack of effect.

After the verification (norm checking) and the comparison, recommendations for improvement should be formulated that can be discussed and implemented within the organization. This is the point where the diagnosis as such stops.

Application of Diagnosis Framework to the Business Case

To collect relevant data on the communication within the process of the settlement of mortgage finance we used semi-structured interviews and observations. We kept an open mind and focused on all sorts of communication that lead to actions. The coding scheme that guided the interviews and observations had to reveal information about the: communicating actors, purpose of the communication, specific messages that are exchanged, medium used, structure of the messages, goal of the message (request, promise, etc.), formulation, coordination and control of communication, breakdowns as a result of miscommunication.

We choose to *represent* the collected data with a UML sequence diagram. A sequence diagram shows the time order in which messages are sent and received among actors and between actors and other objects or systems (Booch, Rumbaugh, Jacobson, 1999).

During the *interpretation* stage we used modelling techniques that are slightly more abstract and take a communicative perspective. An action workflow diagram relates messages to speech-acts. The focus is on representing acts and conversations (Denning, Medina-Mora, 1995; Kethers, Schoop, 2000). This diagram takes a communicative perspective, but its elements correspond almost 1-1 with the sequence diagram and will therefore be used to for the first interpretation of the schematised data.

We used the framework for normative analysis of workflow loops to check the created models of our example on violation of the communication norms as described in the theory. An example norm

violation that was already manifest in the example scenario is that the administrative assistant at the local office is not directly involved in the communication with the service center. However, he seems to be a beneficiary of the work performed by the service center, as he needs to know *at least* the date of the signing. This information is sent to the local office, but does not always reach the administrative assistant. If he is a beneficiary, he should be an evaluator; in other words, he should receive the information and if it is consistent with his own data (the physical file that he possesses), he can give a positive confirmation. Note that in fact there are two related norm violations: one being that the task performed by the service center (on behalf of the local office) is not evaluated and confirmed, the other being that the beneficiary (or one of the beneficiaries) is not involved in the evaluation.¹ An alternative interpretation (interpretations are not always univocal) of the situation is that the administrative assistant is the executor for the service center. But also in that case, there should be a conversation between the two.

The final step in the diagnosis process is a comparison between the diagnostic model and the existing “ought” prescription of the example process.

This may give directions for solutions. Sometimes the problem has to be sought within the acceptance, adoption and integration of the process descriptions within the organization. However, it may also be the case that the process description is incomplete or that it can be improved (process reengineering). Then the diagnosis of the norm violations may give directions for reengineering.

One surprising difference we found is that in the process description the administrative assistant is responsible for sending the tender data to the service center. This means that the process description assumes that the service center employee communicates with the administrative assistant, and this assistant communicates with the service center, and that all the information coming back from the service center has to go directly to the administrative assistant. This is in contrast to what we found in our diagnosis. We note that when the existing process prescription would have been followed, the norms would not have been violated.

The diagnosis has revealed that something is wrong in the “contract” between local office and service center, in which the existing process prescriptions are not followed. The problems that we had in finding out who is the beneficiary are a

Figure 2. Representation: UML sequence diagram (source: Poll, 2002)

Figure 3. Interpretation: Action Workflow diagram (source: Poll, 2002)

reflection of a certain ambiguity in this contract (who is serving whom?).

From Diagnosis to Redesign

At the end of the day, the diagnosis should lead to recommendations for improvement of which we can give here only one example. Roughly speaking, the modeling and interpretation steps of diagnosis give indications of the *occurrence* of problems (such as inefficient or incomplete loops). The verification using norm checking gives indications of the *causes* of these problems. The comparison with the “ought” models gives indications about possible *solutions*. In the abbreviated example of this article, a problem occurrence was noticed in one of the scenarios: although the administrative assistant, in this scenario, needs certain information, he does not get it or only after several attempts. The norm analysis revealed some violations: in particular, the fact that there should be a conversation between administrative assistant and service center. The comparison with

the existing models reveals that in this case, practice deviates from the process description.

Although in practice, the problem is usually dealt with quite well by additional communication within the local office (the informal organization), the recommendation must be to reconsider the “contract” between local office and service center. It must be made clear who does what for whom.

In principle, there are two possible solution directions. One is to reestablish the existing model, that is, to agree that the commercial assistant hands over his work to the administrative assistant, and that the *latter* informs the service center—and also gets the results back. In this approach, the administrative assistant is the customer of the service center. The other approach is to reconsider the process description, assuming that there must be a reason why the prescribed procedure is not followed. In the current practice, the communication chain to the service center is shorter: the commercial assistant circumvents the administrative assistant. This may be more efficient, but as our diagnosis reveals, it

may lead to failures and repair communication afterwards. If this alternative is chosen, at least the communication between commercial assistant and administrative assistant must be improved. Even more important, it must be made clear to all parties that the commercial assistant in this case is the leading customer, and the other parties are supposed to serve him.

To make a good choice, the two approaches must be compared on the basis of criteria such as operational costs, time constraints, and the costs of changing the organization, but also the risks involved and the present failure costs. This needs to be considered before a decision can be made to change anything.

QUALITY MANAGEMENT USING COMMUNICATION NORMS

As much of the basic technological infrastructure such as PCs, software packages, and electronic networks have become widely available, the concept of quality has become increasingly important in the field. Comprehensive methods and philosophies like ISO9001 and Total Quality Management are used to standardize and certify information systems development practices, in order to improve their quality. However, such approaches, popular and useful as they may be, are no panaceas. They lead to much bureaucracy and many ill-understood documents, often do not end up in results that are directly useful for system developers, and do not deal with different perspectives and conflicts of interest. Most often these approaches are grounded in the information flow paradigm. Alternatively, a quality management approach grounded in the information field paradigm can help to optimize the information systems development process (De Moor and Weigand, 2002).

The LAP communication process model makes a distinction between three levels of abstraction in the communication process: the media level, the information level, and the communication level (cf. Dietz, 2005). The media level of communication

describes the physical characteristics of the communication process. The question is: how? How are messages put across? The information level of communication has to do with the data contents. It is not about how messages are transported, but which messages are transported. The communication level is about what people intend to do with messages.

At each process model level, quality attributes can be provided. Quality attributes at the media level include media richness, interactivity, reliability and efficiency. Information quality attributes are for instance integrity, completeness, precision, and timeliness. Integrity constraints in the communication system can be used to enforce some of these qualities. An example of a communication level quality attribute is the communicative rationality expressed by communicating parties in their interactions.

Traditional quality management systems mainly focus on the two lower levels. In reaction to that, the Language/Action Perspective has emphasized the importance of the third level. A comprehensive quality management approach is needed that accounts for all levels and their dependencies.

A fundamental aspect of quality is fitness-for-use. The quality of a tool cannot be assessed without taking into account the goals it has to serve. As a consequence, total quality management should explicitly account for the dependencies between the levels. For example, communicative acts that are aimed at fixing commitments between parties are better served by a medium that offers persistence (such as paper or email), whereas explorative acts are often better served by a medium that does not offer persistence (such as a face-to-face meeting or a telephone call).

Our model takes an information field perspective on information systems, including the three levels of the communication process model. The explicit attention given to the communication level distinguishes our model from perspectives focusing on the technical or use quality. For each layer, relevant quality attributes need to be selected. Then, for each attribute, a customized set of quality management processes needs to be defined.

Core to an information field approach is that for each combination of quality attribute and management process, a set of norms is defined. For example, take the quality control process of the “availability” attribute at the media level. A perceptual norm could say that a user can conclude that his mail inbox does not open anymore when a corresponding error message is received after starting the mail program. A cognitive norm could say that if a mail inbox does not open anymore, then the helpdesk expects that disk space is full. An evaluative norm can be used to conclude when the helpdesk thinks a mail service is faulty—for example, when the allocated disk space is less than 10 MB. Finally, behavioral norms represent the desired actions, for example, that the helpdesk should assign disk space for each new user within 1 day, or that users should clean up their mailbox when they receive a warning.

Example: Improving the quality of a B2B Negotiation Process

We have applied the communication quality model to B2B negotiation, such as supported in the e-commerce prototype MeMo (Weigand et al, 2003). One of the negotiation protocols supported is a so-called tender-based negotiation protocol. This means that a buyer sends a request for bids to a open or closed set of potential sellers. The seller can reply using a bid message. This protocol is often used by contractors in the Dutch building sector.

The quality of the process can be managed at all three communication levels. The medium level quality is determined by attributes such as reliability of the medium (Internet vs. telephone) and timeliness. At the information level, the need for quality requires clarity of product identification terms. The use of standardized product identifications can contribute to this goal. Finally, at communication level, the protocol can be evaluated in the light of the organizational goals. One of the goals is to promote competition among sellers, to reduce prices and to comply with European laws. MeMo found that management sometimes complained about their purchasers not selecting enough potential sellers. One complex aspect that determines different attributes

at the various levels is *competitiveness*. At the media level it may determine an attribute like *security*, which would entail that no company-specific files should be accessible by competing organizations. One—very specific—attribute at the communication process level could be *competitor diversity*, which would mean that enough companies bid for the tender. There are several norms involved, for example with respect to the quality control process of this attribute. First, the manager apparently has an evaluative norm of what is the appropriate number of potential suppliers to be involved in a tender (since he has the authority). This number can be fixed or depend on the amount or product category. To integrate the quality control process in the information system, and possibly automate part of it, the manager should make this norm explicit. To improve the process, the manager can instruct the purchasers to increase the selection set—an example of a behavioral norm for the purchaser.

GROUP PROCESS DESIGN USING COMMUNICATION NORMS

Norms in general and communication norms in particular, are indispensable in diagnosis and evaluation, but they can also directly improve the design of tools and processes. An example can be found in a study performed by Whitworth and McQueen (2003) on group decision making. Many group decision support methods assume a rational process of decision making, as articulated by Simon, and this is reflected in the design of electronic tools (GDSS). In these methods, voting can be done at the end of the process when a choice between alternatives needs to be made. In contrast, the researchers claim that (electronic) voting can be quite useful before and during discussions.

The limitation of the rationalist paradigm is that it largely ignores social influences on group decision making. Each group member does not only perform cognitive tasks—involving factual information exchange and processing—but also is constantly relating to others and representing the group iden-

tity. These are quite different tasks, involving different psychological processes, but they must manifest through the same set of communicative acts. For example, if a certain suggestion is made and a group member has to respond, he can give a positive response because he deems it a good idea. At the same time, he may want to express support to or dismissal of the other person. In fact, whether he likes it or not, his response will be evaluated in that way. That is why it is common to distinguish socio-emotional from task levels in communication, and that is why messages may be self-contradictory. For example, if the group member wants to support the idea but not the person who suggested it, he may express his opinion on the idea on a flat tone. Other group members may misinterpret this expression as lack of support for the idea.

Group members not only relate to each other, they also represent the group identity. This means that they try to maintain agreement on the shared norms of the group, to avoid the group falling apart. “Maintain” should not be interpreted in a conservative sense; it might include active development of the norms as well. Whitworth and McQueen use the term “normative influence” when talking about this communication level, which corresponds to the discourse level as defined by Habermas (1984) and used in the Language-Action Perspective. From the point of view of communicative rationality, group members should be able to express themselves on the discourse level. This (admittedly abstract) rule imposes a design norm on GDSS approaches. It does not mean that every GDSS tool should contain some kind of discourse functionality, as it may also be a design choice to deal with this kind of communication in another way.

Whitworth and McQueen proposed to deal with it by means of voting support throughout the discussion, as an efficient exchange of positions. In other words, the “voting before discussing” not only addresses the discourse norm just mentioned, but efficiency is also considered a relevant norm as far as the implementation is concerned. A small case study was performed in an educational institute in New Zealand, where meetings were held to formu-

late a strategic marketing plan for the institute. The results of the study were encouraging. People were quite satisfied, it apparently reduced or avoided personality clashes and fostered group agreement. As a result, people felt that the process was also more efficient and effective.

CONCLUSION

In this chapter, we have described three different cases. The common denominator is first of all sensitivity to norms. Although norms are often left implicit, for strategic, cognitive or whatever reasons, they do play an essential role in the way people interact and in the systems that they use. The challenge is to explicate the norms without carving them in stone, as living social systems require a certain flexibility, and sometimes even ambiguity. Secondly, we have stressed the centrality of communication norms as far as information systems are concerned. Perhaps this is not that surprising, if we realize what information systems are for, but still too often communication is narrowly interpreted as information flow, and communication norms get overlooked. We have argued for a broad view of communication, from the physical (medium) level up to the social aspects.

Of course, the focus on communication is a limitation. For instance, economic norms (cost/benefit ratio) also play a role, especially in commercial companies. We do not claim that only communication norms are relevant, but claim that they should be recognized in their own right, not the least because we live more and more in a communication society. Consistent violation of communication norms will have an economic effect (e.g. higher failure costs), but benefits and costs are not always easy to estimate. Even if it is possible in a certain situation, the economic analysis alone gives poor guidelines on what to improve. Communication norms provide designers with objective quality criteria that help to sort out the good and the bad in current processes and in what customers may want.

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KEY TERMS

Communication: a complex social process in which people coordinate their behavior by creating and maintaining a shared definition of the situation

Communication norm: a rule governing communication practices based on shared expectations

Diagnosis: an analysis process that aims to reveal the causes of a complaint or expressed problem

Language/Action Perspective (LAP): a perspective on Information Systems that focuses on what people do and achieve when they communicate.

Problem: a difference between the actual state of something and what is desired by some stakeholder.

Quality: a characteristic of something that is of value to someone or for a certain task

Rationalism: the belief that action and decision making should be governed by reason only