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# Signs of Work

Semiosis and Information Processing  
in Organisations

Edited by

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## Preface

# The Potential Contribution of Semiotics and Systems Theory to the Continuing Evolution of Information Systems Research

HEINZ K. KLEIN

During the last decade information system research has grown dramatically to embrace the insights of several philosophical traditions. Both the scope and sophistication of information systems research have benefited from this. The purpose of this general introduction is to sketch how the papers collected in this unique monograph fit into the intellectual landscape of research on information systems as we now know it from the Information Systems journals and how they might influence its future shape.

I will first propose some basic distinctions to characterize the major lines of thought which have sparked the debate in Information Systems. I will then use some of the papers as examples to illustrate the significance of these distinctions and to show how the semiotic viewpoint shared by this collection of papers can shed new light on certain aspects of the debate. Of course, any attempt to summarize a decade of literature debate in a paragraph or two runs the risk of using too broad brush blurring the details. However, I believe that this risk is worth taking if the simplifications throw a few basic points into relief that matter not only for the insider of information systems research, but also for those readers who approach this collection of papers from the vantage point of another discipline.

## Major Schools of Thought in Information Systems Research

In this section I attempt to characterize some major lines of research in information systems in terms of their ontological and epistemological presuppositions. I am bringing up the subject of ontology and epistemology because it has sparked major debates in information systems research for more than a decade. It will also be useful to reflect where the papers in this volume stand on matters epistemological and ontological.

Much of the fuel for the debate in information systems research has come from two fronts. One has emerged from rediscovering the significance of an old epistemological conflict about the nature of human knowledge in the context of information systems. This is natural as 'information' and knowledge are close cousins. Hence theories about knowledge and knowledge acquisition have direct implications for information systems design and use. The other front has formed around the question whether information systems design should help to stabilize the existing social order or help to discover and overcome its limitations for achieving a better way of life for all. The second conflict is often formulated with focus on organizational goals: Should information systems help to meet organizational goals as they are or help to reformulate these goals so that people can emancipate themselves from unwarranted constraints and better realize their potentials (Lyytinen 1992; Hirschheim, Klein 1994). More recently, a third front has been opened around the question whether information systems development can be anchored to given organizational structures which provide a persistent backdrop for systems development or whether structures are just fleeting images in a sea of change. In the former case, information systems can be analyzed as stabilizers in the latter case as vehicles of change which help the organization to maintain a sense of self when 'everything is in flux' (cf. Heracleitus' image that you can never swim in the same river twice).

The first front is essentially an epistemological and ontological one, the second an ethical one and the third one of research strategy. The first front is concerned with questions about the nature of reality and how we can learn about it. Researchers taking the position that the ultimate source of human knowledge is not experience but the constructions of the mind, are now often referred to as interpretivists or social constructivists. Those holding the opposing viewpoint, still the majority, are often labeled realists or positivists. Realists focus on the objective side of phenomena either on modeling things 'as they are' or as they are perceived by some subject. Ultimately they believe that there is a reality core which exists independently of any perceiving subject. Constructivist are interested in learning how the design and use of information systems intervenes in the construction of a socially shared reality. Whether or not a reality exists is moot because we can learn about it only through sharing our ideas of it, there is no immediate, privileged access to reality. Reducing the debate to its simplest denominator, one can say that the two sides differ in their beliefs on whether the ultimate source of knowledge is the human mind or the external world. One side believes that experience is the ultimate arbiter of truth, the other that "experience only confirms what the concept teaches" (Hegel).

The third front is directly influenced by the linguistic turn, i.e. namely that whatever counts as reality, to us humans is only accessible through the medium of language. Insofar as information systems affect language, they are

reality constructors because they intervene in the process by which their users perceive, create and describe a shared reality.

As a discipline, Information Systems started in the sixties with an overwhelming bias towards realism and positivist research methodologies. Since the seventies it has made immense strides to put into place the intellectual foundations for a social constructivist approach to studying information systems by adopting principles and methods which are inspired by the philosophical schools of hermeneutics and phenomenology. Two good references documenting this broadening of the nature of information systems research are Nissen et al. (1990) and Hirschheim, Klein, Lyytinen (1995). In comparison to realism and constructivism in information systems research, the emergence theory of information systems is still in the making, in fact, there is not even a common terminology. It is closely connected to the proliferation of alternative or hybrid forms of organization in industry (cf. Applegate 1994). Besides emergent organizations (cf. Truex, Klein 1991; Baskerville, Travis, Truex 1992), such terms as virtual, self-designing or self-organizing, adaptive, autopoietic, and others are used to refer to constructs and phenomena which are at the core of this line of research (a cross-section of the pertinent literature is reviewed in Truex 1993:36).

## Two Conjectures

The current volume takes a position in this debate which should be of interest to their participants regardless of their loyalty to one or the other philosophical school. For realists, any depiction or model of reality can only be as good as the language used to describe it and constructivists will agree that it is only through language that the mind can express its constructions. Moreover, since Tarski's analysis of semantical paradoxes, realists have accepted that natural language is the ultimate meta-language which is needed to give meaning and significance to any artificial language formalism, no matter how cleverly devised. Hence the study of how languages, be they formal or natural, 'empirically' affect signification in organizations, is of great interest to the realist camp in Information Systems. Constructivists on the other hand are predisposed to studying language as the medium which affects the social processes of sense-making and reality construction. For them, language is not only a medium of expression but an active force shaping the way the mind functions. From this vantage point, the following collection of papers also contains much food for thought papers to sharpen ideas on how all this happens and what the consequences are of the different ways in which it happens.

One critical shortcoming of the realist-constructivist debate has been the lack of communication between the two camps. The focus on language which

this book suggests, could overcome the lack of a critical mass of ideas and concepts which is necessary to make any real communication possible among adherents to alternative philosophical traditions in research. The conceptual base which emerges from the following papers could be a milestone in overcoming this communication gap. From this perspective, this volume could also become a milestone on the further development of emergence theory because from its start, emergence theory has not only recognized the importance of language, but also drawn important inspirations from language theories in form of analogies and metaphors. In particular it has drawn on the theory of emergent grammar to gain insight how organizations could realize autopoiesis, i.e. how they are continually re-making themselves.<sup>1</sup> As (with one exception) the following papers combine both conceptual and empirical work, they add detail and sophistication to understanding organizations as autopoietic systems in a form which should be of interest to realists and constructivists alike even though each may wish to take exceptions to some of the assumptions made.

The reference to autopoiesis points to a second shortcoming in the current debate in Information Systems, namely the way in which systems theory has been absorbed. With some notable research contributions (e.g. Winograd and Flores 1987), system theoretic notions in the information systems literature abound mostly in the form of concepts relating to system structure and boundary. Hence classical, physical systems theoretic notions are the most influential in the information systems literature. Meanwhile the theoretical discussion in systems theory has progressed from equilibrium seeking (structure maintaining) to autopoietic (self-making) and self-referential systems. Self-referential systems maintain symbolic processes which determine ego and alter, i.e. which identify on a case by case basis the difference between inside and outside, us vs. them etc. To do this, self-referential systems must maintain and make use of identity, i.e. a symbolic image of self which they need to define what they are and what they are not. This transition from structure maintenance to identity preserving systems notions has amounted to no less than a paradigm shift in systems theory. Clearly with the penetration of computer-based information systems into all organizational processes, information systems

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<sup>1</sup> The meaning of "emergent grammar" is best explained by comparing it with the conventional notion of structural grammar. Structural grammar is conventionally understood as a set of rules which are stable across a multitude of conversations (diachronical) and act as shared language forms (templates) which make communication among speakers and hearers possible. Typically, structural grammar is construed to consist of a given set of rules which operate on fixed categories like nouns and verbs, specify how they can be modified through case, tense, modality, etc. and constrain the order in which they may appear to make well-formed sentences. Meanings are expressed by obeying these rules when speaking. Hopper (1988) has challenged this notion of (structural) grammar by documenting how grammars evolve with emergent cultures. Like cultures, they are temporal, emergent and disputed, always under negotiation and contingent on context of use, i.e. synchronical. For example, agreements about the meanings of words cannot be separated from agreements about the substantives issues under consideration. Likewise all language forms are as fluid as forms of life (Wittgenstein).



must have become part of the identity formation processes determining what organizations are, the essence of their personality so to speak. Unfortunately, not much has been published on the consequences of this phenomenon for our understanding of the role information systems in real world contexts. Mapping the terrain of design and use of information systems from the perspective of modern system theory awaits discovery. It is therefore gratifying to note that the following collection of papers includes only both introductions to some of the newer conceptual developments of systems theory (e.g. Andersen, Jørgensen), as well as contributions which describe experiential implications of the paradigm shift in systems theory.

### Some Illustrations

Each paper in this volume occupies a unique position in the matrix of the major intellectual forces which I have tried to characterize. Together they document a stage in the debate which has both methodological and substantive (contents) implications.

Methodologically, all papers merge elements from different philosophical positions into a unique blend which suits their varying purposes (this is explicitly recognized in Stamper's contribution). It would therefore not only be futile, but contrary to the spirit of this documentation of a certain stage in the discussion to ask which papers are more positivist and which are more constructivist. A more useful question is to ask what does the methodological stance which the author assumes and which may offend philosophical purists contribute to answering the research question to which the paper is addressed and how does it limit the results. For example, the *apriori* categories used in Klein and Truex impose a structure on the data which is contrary to the spirit of interpretivist research (in fact it is in part suggested by the reincarnation of structuralist grammatical analysis as proposed by Searle), but at the same time it points to possible generalizations which usually are beyond the reach of interpretivist field studies. Positivists may be concerned with the lack of statistical significance, but must recognize that hundreds of multivariate analysis have failed to shed light on the issues to which Klein and Truex speak. Similar questions can be raised about the other papers which mix formalism with field data, e.g. Madsen or Schmidt or Hørlück.

By the same token, none of the papers can be classified as 'critical', i.e. as directly confronting the issue of how language relates to human interests, how language use maintains power relations, distorts communication or related topics, yet most have 'windows' which shed critical light on questions of organizational participation (democracy) and politics. For example, Bærentsen's observation that machinists spend much time telling stories can be taken to

mean that the main force keeping the power plant working is self-organization, that story telling is not just a past time lowering productivity but essential for maintaining identity and coordinated problem solving capacity. Clarke discusses the role of information systems as stabilizers of (obsolete) power relations and in Hørlück EDI is described as a tool which powerful buyers use to control smaller suppliers. This in turn may eventually change the structure of the market itself, presumably bringing it closer to the socialist ideal of a planned economy. Anderson's paper confronts the reader with a startling critical implication: if organizations are the result of self-organizing processes during which chaotic phases are inevitable, then the role of management tends to shrink from 'rational controllers and planners' to make-believe magicians who try to convince themselves and others that processes actually outside management control are still caused by rational management decisions. All of the above point to the conclusion that 'designing for democracy' is a rather complicated affair, especially if seen in the light of autopoiesis and self-reference.

In turning from questions of methodology to questions of substantive contents, it is interesting to note the vision which almost all papers share of the nature and role of information systems. With the exception of Bødker, they tend to be more concerned with information systems as communication and sense-making media than as social or technical control instruments. When we speak of sense-making we think of the creation and sharing of new meanings such as typically occurs in the context of judgmental decision making or social consensus formation. The sense-making function of information systems supports human actions which have the primary orientation to achieve (sincere) agreement on opinions, values, goals, means, perceptions of facts, hopes — anything of shared concern. 'Sincere' means that all sides 'negotiate' in good faith, i.e. own up to their feelings, mean what they say, do not engage in manipulative tactics etc. Habermas calls this type of action 'communicative' and I defer to Jørgensens paper for further explanation of communicative action.

In distinction to this, the control functions of information systems are concerned with the efficient and effective achievement of predefined goals which are presumed to be taken for granted. While the research emphasis on sense-making phenomena is hardly surprising when approaching the research reported here from a semiotic/linguistic perspective, it stands in startling contrast to the mainstream literature in Information Systems as we know it from the journals specializing in information systems research. Most information systems research as published to-date, tends to focus on the control functions of information systems in the context of economic and technical concerns for improving efficiency or effectiveness. Only very recently has this been changing, in particular in the research specialization of group support systems or CSCW (cooperative support of cooperative work) as it is sometimes called.

To illustrate the proposed distinction of information systems roles as sense-making media and control instruments further, consider the difference between instrumental and strategic actions in organizations. Both of these presume that the actors are primarily success-oriented to achieve goals which are taken for granted. In strategic action we are conscious of the fact that we deal with one or more rational opponents who in turn try to control us, similar to a game in which only one party can win. In this type of situation counter-measures have to be anticipated and the consequences of one's own action evaluated in light of possible counter-measures. In instrumental action, people are looked upon as willing means which follow orders. An example might be smoothly functioning 'operating units' (as Boguslaw 1965 discusses) like a bureaucratic office department working under a supervisor or an assembly line. Of course, in real life ambiguous situations may occur. There is one paper which addresses system control (Bærentsen), but as will become clear it does not address the instrumental or strategic aspects of control. Examples of sense-making support are all systems devised to dissolve ambiguity, i.e. many decision or executive support systems, planning information systems, marketing research information systems and the like. To expand on this it is helpful to distinguish the following three sense-making situations and relate them to the contents of this book:

- Making sense of facts and opinions, complex situations, trends and the like. A good example is Schmidt's paper on diagnostic work or Bærentsen's analysis of the cognitive processes which allow experts to sort out confusing situations in control of complex systems.
- Interpreting shared norms or laws as typically happens in a court of law. Examples might be a loan processing system which helps a financial officer to determine if a loan application meets company guidelines and policies for granting loans or a legal information retrieval system which help to match a new case to applicable precedence and legal principles.
- Making sense of complex sequences of arguments and counter-arguments when a group of people such as a jury is in search for answers to questions of truth, justice (fairness) or good taste and no clear norms or principles apply or when the grounds for such norms themselves are at stake. Examples are some decision room applications, 'virtual committee' or conferencing systems or the research on dialectical information systems.

There are at least two papers which are directly concerned with taxonomical issues of this type. Both Klein and Truex as well as Jørgensen bear on the issue how the range of sense-making activities could be conceptualized. In part they use the same social theories, i.e. Habermas' theory of Communicative Action.

Stamper's paper outlines Gibson's theory of sense data interpretation. The last part of the paper can be interpreted as an attempt to capture the shared norms of reality interpretation in ontological models which map the structure of information systems. Clarke provides concrete evidence how the intellectual structure of obsolete information systems 'stays behind' in the minds of users and continues to affect their sense-making.

It is clear from these examples that the contribution or impact of information systems on organizational sense-making occupies the foreground of the research presented in this book. This impression is confirmed if one considers how the papers can be grouped around common ideas, research questions or observations. In this way, selected papers can form natural pairs or triples complementing each other in contributing to common substantive questions by shedding light on related empirical phenomena. For example, Joergensen speaks in the latter half of his paper about the way in which communication constitutes the nerve and pulsating heartbeat of the organization. He points to greetings, coordinations of tasks, reminders and the like. Both Klein, Truex and Bærentsen add more finely grained empirical detail how this manifests itself. Of course, both papers invite the reader to reflect the reported examples of language use to the notions of self-reference and self-organization. Andersen, in his introductory piece singles out the stabilizing force of signs, Stamper suggests the details of a symbolism by which stable regularities can be used to capture organizational conventions in 'ontological models'. Thereby information systems can become stabilizers by freezing certain sign constellations. A similar inference follows from Klein and Truex claim that structures can be 'frozen' (kept artificially stable) by the fiat of power (but unlike Stamper they do not suggest the details of a modeling mechanism by which this might be accomplished). Hørlück gives examples for ways in which computer systems (EDI in his case) 'freeze' certain communication patterns and how this robs the organization of flexibility. Bærentsen observes a similar mechanism in the design of DSS where canned solutions become incomprehensible to humans and thereby may obstruct rather than facilitate shared sense-making. Klein and Truex point to the importance of interpretations in emergence, but leave out where the ideas originate which become the subject of shared sense-making. Bærentsen's concept of episodic knowledge and memory could contribute some details of the dynamics of emergence: it points to the episodic memory as a possible link to the environment from which unpredictable events intrude into the linguistic processes described by Truex and Klein.

In summary then all papers are analytical, because they attempt to develop a theoretical grounding for a scientific problem which is most often related to self-organization. But since self-organization is also a value they tend to have conceptual critical implications and practical political consequences. These are not always made as explicit as they could be and hopefully the preceding

examples will help to see these aspects more clearly. Furthermore, I have tried to explain why the approaches taken by the researchers contributing to this volume could help to overcome the fundamental paradigmatic deadlock which currently exists in the Information Research Community. As long as the advocates of fundamentally opposed methodological positions (e.g. positivism vs. constructivism) recognize that each has its peculiar weaknesses, it should be easy to reinterpret the situation as an opportunity for mutual learning on matters of research strategy and methodology. The following papers provide a wide spectrum of new view points which can serve as bridge heads for venturing forth into uncharted territories.

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# I. FORMAL SIGN SYSTEMS



## Introduction

### Signs and Work

PETER BØGH ANDERSEN

The papers in this part treat the formal aspects of signs in organisations, either by having computer systems as their topic, or by being strongly motivated by them. *Jens Hørlück* discusses Electronic Data Interchange from a Peircean point of view, *Rodney J. Clarke* uses systemic linguistics to describe the interplay between a registration system and its semiotic context, *Kim Halskov Madsen* re-interprets object-oriented programming in semiotic terms, and *Karl-Heinrich Schmidt* analyses medical diagnostic work with special reference to its means of representation (measurements, pictures, and verbal language). Finally, *Peter Bøgh Andersen* suggests that the new field of morphodynamics may yield new useful concepts for understanding organisational communication.

The motivation for including papers with focus on computational and formal topics in a book about the signs of the work-organisation is simply that the past decades' introduction of computers into organisations has conferred a bodily existence to signs with a formal definition. The formal point of view is no longer merely a perspective that one may choose to apply or not. The formal approach is an *active* force that has in fact *changed* the semiotic nature of organisations.

Apart from their concern with the formal aspects of signs, the papers of this section happen to share two important points of view:

- (1) Their general viewpoint is *dynamic*. For example, the 'technical papers' of Hørlück and Madsen both emphasise the development and implementation of the systems; Clarke's paper is a historical account of the evolvement of a system and its context; Schmidt embeds his formal description of diagnosis in medical history, and shows how the verbal and pictorial representations interact during diagnosis; and Andersen views organisational communication and action through the glasses of morpho-dynamics.

- (2) They see signs and work as *mutually stabilising systems*. This is evident in Clarke's paper, that demonstrates how computer systems generate particular genres of conversation which are able to maintain themselves, even after the systems have become obsolete. Smith emphasises 'the need for competent verbalisation' of non-verbal representations, such as X-Rays, in order to enable decision-making and communication among doctors. In fact, he even restricts the notion of *symptom* to only cover verbal descriptions. Hørlück shows how EDI, by standardising economic transactions between companies, influences the internal working procedures of the trading partners. Finally, the notion of stabilisation is used by Andersen to account for the persistence of emergent phenomena, such as classes of objects, types of acts, and fixed patterns of task structure: patterns of signifiers are said to create new levels— words forming sentences, sentences discourses — that feed back to the level of signifieds below, so that words stabilise classes of objects, sentences types of actions, and discourses make tasks persistent.

In this introduction, I shall try to develop a framework in which the individual papers can be positioned and compared.

My point of departure is the classification and naming of objects discussed by Schmidt. Diagnostic work aims at assigning a diagnostic description to a set of measurement, such as temperature measurements, x-ray pictures, tomograms, electroencephalography, etc.

by means of evaluations of measurements and observations, hypotheses about class and localisation of a disease are generated and proved until no further symptom or evaluation alters the set of diagnosable entities (i.e. classes of disease and their localisations). This implies the following model of diagnostic work: An observer generates a (at the beginning initial) hypothesis for a patient. Building on the actual hypothesis the observer specifies further observations or measurements suitable for verification. This leads to new symptoms or evaluations. According to the local criteria of diagnostic reasoning the set of diagnosable entities is changed (or not). This process is continued for as long as no further observation or measurement promises to be successful according to the applied diagnostic criteria. The resulting set of diagnosable entities can be viewed as a fixed point set of the diagnostic process.  
(Karl-Heinrich Schmidt)

If  $x$  represents the current set of possible diseases and  $D$  denotes diagnostic work, the diagnostic process continues as long as  $x_t \neq D(x_t)$ , i.e. as long as new possible diseases can be found. When further observations do not produce new diagnosable entities, the process terminates.

Formally, an  $x$  such that  $x = D(x)$ , is called a *fixed point* of  $D$ . Fixed points belong to a larger group of mathematical concepts called *attractors*, a concept that is used in Andersen's paper to define *form* and *change of form*. Attractors can be used to define form because they are sets of states a process will

approach when iterated sufficiently many times, and where it will subsequently stay forever. They characterise the long term behaviour of an undisturbed system. Consequently, a change of attractors can be interpreted as a change of form, since the system now begins to behave in a qualitatively different way.

The set may consist of only one state, in which case we have Schmidt's fixed point attractor, but it may also be a cycle of states between which the system oscillates<sup>2</sup>. The concept of semiosis implied by Schmidt's and Andersen's papers is a dynamic one, where signifier and signified stabilise each other. In Schmidt's case, the possible diagnoses can be said to stabilise the process by yielding the criteria for the fixed point of measurements, and the set of measurements stabilise the set of diagnoses so that, eventually, new possibilities stop showing up.

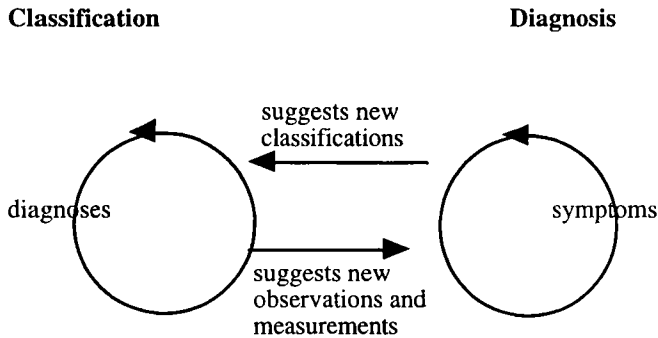


Fig. 1. Schmidt: Stabilisations at the level of words

Fig. 1 illustrates the stabilising function of the diagnostic signs. Combining Schmidt's and Andersen's approaches, we can say that the purpose of classification is to combine a subject ('John Doe', the patient) with one out of a set of predicates ('has a brain tumour', 'has cerebral haemorrhage',...). The function of the diagnostic process is to create a stable attractor for the subject in the semantic field of names of illnesses, but the diagnostic process itself needs guidance from the classification system feeding back to the diagnostic process by defining the fixed-point attractor where the investigation comes to rest.

A similar description of classification, emphasising its processual character and its stabilisation inside an attractor, is given in Andersen's contribution; only in this case, the purpose is not to produce a diagnosis of an illness, but

<sup>2</sup> A meeting is a good example: it is quite possible for an unsuccessful meeting to end by oscillating between two positions, e.g. between declining or accepting an offer:

Contribution(accept offer) = decline offer  
Contribution(decline offer) = accept offer

rather to classify a fault in a computer system. Whereas Andersen's paper only discusses verbal signifiers, Schmidt's paper very convincingly demonstrates the need for an integrated description of verbal and pictorial representations in organisational semiotics.

The indirect coupling between environment and signs implied in Fig. 1 recurs in Clarke's paper, not at the level of words, but at the level of conversations. Clarke notices that conversations divide into genres that are influenced by a *contextual configuration*. The contextual configuration influences conversations through three main variables

that are realised by the functional component of the semantic system, *field* (Social Actions and Activities), *tenor* (Roles and Relationships between Participants) and *mode* (Performative Aspect of the Text). Field, Tenor and Mode are suitable for describing the situational aspects of texts in general. (Rodney J. Clarke)

*Field, tenor and mode* was originally suggested by the linguist M. A. K. Halliday as situational parameters that influence the linguistic register. Halliday (1978: 221 ff) offers the following definition:

- *Field*: the nature of the activity, and subject matter. (The specific tasks of the work situation, and the means of production: tools and raw materials)
- *Tenor*: the role relationships among the participants. (The work organisation, the social relations, and the roles of the work situation)
- *Mode*: the channel, and the part played by language in the total event.

and postulates close linkages to the ideational, interpersonal, and textual linguistic subsystems:

- *Field* → *ideational subsystem* (e.g. the active/passive inflection, the 'Aktionsart' of the sentence)
- *Tenor* → *interpersonal subsystem* (e.g. the mood inflection)
- *Mode* → *textual subsystem* (e.g. the theme/rheme opposition)

But Clarke, quoting R. Hasan, objects that the contextual configuration does not directly determine our choice of words and sentences:

we cannot work from the general notion of, say, 'field' since it is not possible to claim, for example, that field always leads to the appearance of this or that element. Moreover, often a combination of features from more than one variable [instance of field, tenor, mode] might motivate the appearance of some single element of a text (Rodney J. Clarke)

Thus, the influence from situation to language is more holistic and indirect: it seems to be the case that a particular configuration creates, not a particular linguistic construction, but a particular genre, a coherent pattern of behaviour that guides our choice of linguistic constructions.



Hasan develops the concept of a Generic Structure Potential (GSP). The GSP is a formalism for showing the canonical arrangement of elements (element sequence), iteration, and element type (obligatory or optional) which describes the features of all texts associated with a given contextual configuration. *(Rodney J. Clarke )*

If we re-use the concepts derived from Schmidt's and Andersen's papers, this hypothesis can be depicted in Fig. 2.

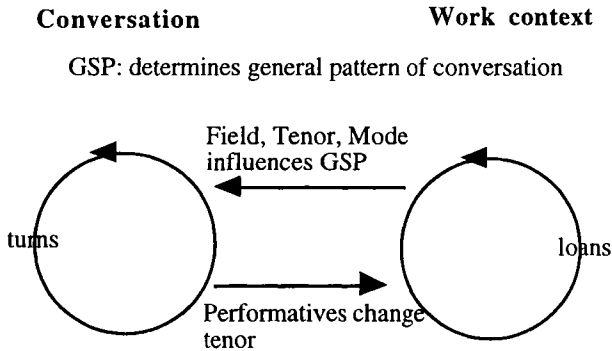


Fig. 2. Clarke: Stabilisation at the level of conversations

Again we have two systems that must continually be reproduced: conversations must keep producing conversational turns, since otherwise the conversations would die, and the Microcomputer Laboratories must keep producing loans, since otherwise the organisation would go out of business. The pattern, according to which turns are produced, conforms to the Generic Structure Potential which again is influenced by the Field, Tenor and Mode parameters of the situational context, and, as Clarke notes, conversations can feed back to the tenor component of the situational context, since we use language to maintain or change social relations (appointments, discharges, verdicts, promises, orders):

The commissioning of ALABS standardised and stabilised tenor relationships, that is the relative statuses and roles of trainees and other laboratory staff, and formalised the relationship between Microcomputer Laboratories staff and students. *(Rodney J. Clarke )*

A main point in Clarke's paper is that the GPS achieves a certain degree of autonomy, since the situational context can change considerably without causing changes in the GPS:

The system studied 'persists' ... in its organisation, and indeed still continues to be of influence, long after it has been effectively decommissioned, especially in terms of the types of social actors and roles which it was instrumental in producing at the Microcomputer Laboratories. *(Rodney J. Clarke )*

The analysis given above, where the situational context is not allowed to directly influence the choice of words, but only to act as a parameter to a genre-defining linguistic mechanism, predicts this result: a formal account of such delayed changes can be given in terms of catastrophe theory, as described in Andersen's paper.

It seems possible set up a loose correspondence between Clarke's and Schmidt's concepts: Schmidt's measurements and evaluations of the bodily scene, for example

- increasing stiffness caused by defect gyrus postcentralis
- slowing EEG frequency of left lobus frontalis

seem to play the same role as Clarke's Field, Tenor, and Mode 'measurements' of the social scene, for example

- FIELD: Social Activity: Student returns valuable items to the Microcomputer Laboratories Staff Member. The items may be software, manuals or hardware. Returns are handled by a Laboratories Staff Member who records the return using the ALABS Student Return feature
- TENOR: Dyads (Hierarchical or Non-Hierarchical): Hierarchical dyad with student as subordinate, and staff member as superordinate. Social Distance (Maximal or Minimal): Near maximal but reduced compared to Student Loan

since in both cases the verbal system is stabilised. In the former case, 'the patient' finds rest on the predicate 'tumour', in the second case, a particular Generic Structure Potential is established.

Hørlück's paper discusses the same linguistic level as Clarke's, namely the level of conversations, and he too is concerned with the interplay between computer systems and work procedures. However, whereas the computer system in Clarke's paper is seen as a part of the contextual configuration — the environment of the conversations — where it

typically acts to *constrain* the dialogue, [but] by no means *determines* the dialogue nor the generic structure. (Rodney J. Clarke )

the communicative impact of computers is far more tangible in Hørlück's case, where human communication is replaced by a computer system that certainly does determine the dialogue.

Hørlück discusses the communicative role of the EDI-system: if human communication goes into the 'conversation' box, then why should we not put EDI systems there too; after all, they merely replace the human acts? Are computer systems vehicles of communication or are they environments of communication (as Clarke will have it)?

Hørluck seems to reject the first option:

As argued above, this program is not a real interpreter, but only a set of algorithms, formulated at a specific point in time by a human interpreter. *(Jens Hørluck)*

and suggests that EDI is seen as a mechanical realisation of human communicative decisions taken beforehand, during the development of the EDI system — a sort of ‘canned’ communication:

the selected messages are the social systems’ interpretation of a chosen set taken from all the possible messages, and the computer programs are the organisational interpretation of the chosen set of rules, decisions and actions related to those messages. *(Jens Hørluck)*

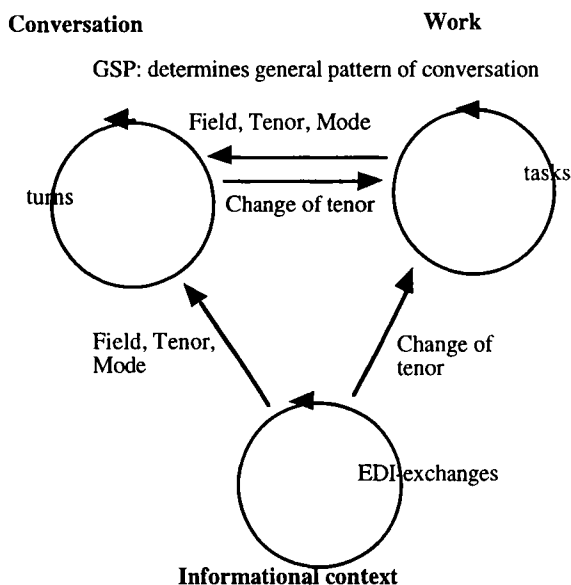


Fig. 3. Hørluck : Computer systems: system and environment.

Fig. 3 shows one way of summarising these ideas. Communicative computer systems, such as EDI, seem to play two roles at the same time. On the one hand, they are machines, and as such form a part of the working context and influence Field (The ‘what’ of the situation), Tenor (the roles of the situation), and Mode (the channels of communication).

However, they are also communicative systems, and as such influence the tenor of the situational context by establishing commitments between trading partners. EDI clearly demonstrates that performatives, such as selling, buying, etc., can have legal force even if performed through computers.

Hørluck agrees with Clarke that computer systems can change field and tenor: EDI, he says,

will have a profound effect on working routines and procedures and [...] large companies will extend their market power beyond previous boundaries. (Jens Hørluck )

In fact, the main problem in installing EDI is pragmatics and neither semantics nor syntactics.

It is my intention to show that pragmatics is underestimated and that the real hindrance to the growth of EDI usage is a lack of understanding of the pragmatic dimension of automating communication. (Jens Hørluck )

In Fig. 3, there is no influence from human conversations and situational context to computers. The purpose is of course not to deny such influence (after all, computer systems are man-made), but merely to emphasise the difference between real conversations and EDI, namely that immediate feed-back from the context of situation to modes of communicating is normally not possible in computer systems.

Whereas natural language offers a rich set of meta-signs that are used to *control* ('Next speaker, please'), *change* ('We seem to be getting too far from our topic, can we please return to the agenda?'), and *repair* ('Excuse me, I didn't quite catch your meaning') the human conversation, computer systems change in a different way: Being a sort of canned communication, they must be planned, agreements and standards must be reached before the actual communication can get going, and complaints and inconveniences cannot be corrected on the spot, but may need to go via committees and boards, a process that is thoroughly documented in Hørluck's paper.

Kim Halskov Madsen's paper presents a semiotic starting point for understanding this new and not yet fully understood type of semiosis. Hørluck suggested that we need to take a "broader view and look at the definition and design of the EDI systems on both sides and the way the handling of EDI messages are programmed in the applications" in order to develop consistent concepts for computer-effected communication, and Halskov's paper does exactly this. Starting with a simple banking system, where the system is classified as a representamen, the customers' economic affairs as object, and the interpretant is produced by the clerk and customer, Halskov gradually complicates the picture by introducing the design situation, the programming language definition and the physical machine.

His analysis demonstrates that, in reality, an ordinary computer application consists of a rich set of different sign-types with different interpreters. In particular, the program text turns out to be a sign that expresses Hørluck's general "organisational interpretation of the chosen set of rules, decisions and actions": How tasks, such as depositing, are normally performed, how entities, such as accounts, are normally built.

Andersen's paper differs from the other papers of Part I by not having a concrete work process or type of application as its topic, but it shares the focus

on dynamics and the notion of a mutual stabilisation of signs and organisational behaviour.

The purpose of the paper is theoretical, namely to introduce the notion of morphodynamics — the dynamics of the emergence and development of form — and suggest applications to organisational communication. Whereas structural methods normally describe existing forms, e.g. the morphology of an animal or the semantic fields of a language,

the new research agenda requires the sciences to also account for the process whereby the forms emerge. If, in addition, we do not assume a divine interference in nature, then we can further specify the morphogenetic problem as a problem of *self-organisation*...

(Peter Bøgh Andersen)

The paper explores two models for describing morphodynamics, namely *catastrophe theory* and *cellular automata*. Authentic data are used as illustration. In the morphodynamic framework, organisational structures are seen as emergent properties resulting from self-organisational processes, and a main problem is how these structures can stabilise themselves and even constrain the lower-level processes that triggered them in the first place, cf. Clarke's paper. How can emergent structures be causally effective? The paper tentatively suggests that signs and communication may play a decisive role in biological and social emergence.

The paper relates to two papers in Part II, namely Bærentsen's paper and Stamper's paper. It presents data from Bærentsen's research as an example of self-organising processes using story-telling as a medium, and it shares a basic view with Stamper's paper, namely that organisations can be seen as

a field of force that makes the members of the community tend to behave or think in a certain way

(R. Stamper)

However, the formal apparatus differs from Stamper's: whereas Stamper uses discrete entities — a combination of logic and ontological dependency graphs — Andersen's paper uses catastrophe theory which is based on continuous functions.

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# Interorganisational Systems: Communication, Cooperation, or Governance?

JENS HØRLÜCK

## 1. Electronic Data Interchange: concepts and definitions

This article is about computer to computer communication without human intervention. Furthermore, the computers involved are not within the same organisation. This type of DP systems is rapidly increasing in numbers and scope and is therefore an integral part of the trend of information technology.

### 1.1 Introduction

In the beginning of the 60s, a company called American Hospital Supply Corporation (AHS) set up a direct link between some of their customers and their ordering system so that the customers could enter orders directly into AHS's computer department, and as early as 1966 Felix Kaufman wrote

Thus company boundaries are not the only, or even the most meaningful, system boundaries.

In his visionary article he described what has later become known as interorganisational systems (IOS). Neither the AHS system nor Kaufman's article described computer to computer communication. The technical and organisational competence did not suffice to leave out human interference.

Since then, and especially during the last decade, the integration of systems from different organisations has gained acceptance. One of the fastest growing types of exchange in most of the developed countries is Electronic Data Interchange (EDI). EDI is a way of exchanging structured information and EDI is often seen as one of the ways of increasing a company's competitiveness.

It might be viewed as just a purely technical question, only to be dealt with by computer scientists, but as this article will demonstrate, there is far more to EDI than the exchange of electronic signals.

The first section provides some basic knowledge of the topic of this article: EDI. This is done in very general terms and without specific examples.

In Section 2 the advantages and disadvantages of EDI are briefly listed and discussed together with a discussion on how and why EDI is spreading.

In Section 3 EDI is defined in terms normally used in semiotics. I have defined the syntactics, semantics and pragmatics of EDI. Since syntactics is of minor importance in relation to this article, it will not be dealt with further.

Section 4 deals with the standard of interchange, its creation and evolution. A translation of a standard document is demonstrated.

Section 5 includes a short description of the standard EDIFACT, its syntax and its semantics. This is further described in the Appendix.

Section 6 discusses semantic issues of EDI and the following sections discuss the pragmatics and semantics of EDI. I will argue that this type of communication will have a profound effect on working routines and procedures and that large companies will extend their market power beyond previous boundaries. Through examples I will demonstrate that there are several grades of consequences from implementing EDI.

In some instances it is just a tool for exchanging the same data faster and in a more reliable way and in those cases the consequences are quite easy to deal with. It might 'just' be a question of reducing the labour force. On the other hand, in most cases EDI is not cost justified by this kind of savings.

Some of the examples involve only minor modifications of work procedures and applications, such as changing the way names and addresses are stored and used. Others involve more substantial changes, because EDI removes the human filter that is normally used to control input to working procedures and applications.

The most profound changes, however, are due to the fact that EDI is a small but important element of the supply chain management of a large company. EDI allows this to extend into suppliers' and customers' organisations. This is normally described as 'more intensive cooperation', but might just as well be called extension of power.

## 1.2 How trading used to be done

Figure 1 illustrates the pre-EDI conditions in the construction industry to clarify the concept of EDI to the reader.

The customer, e.g. a constructor working on a construction subcontract, sends a request for a quotation to a number of potential suppliers of construction material.

Each of these suppliers calculates their prices for the specified request. This calculation includes prices, payment terms, frequency of delivery, and many



other objective criteria. On top of this comes a more subjective judgement, which can lower or raise the calculated amount. One possibility is the decision not to send a quotation.

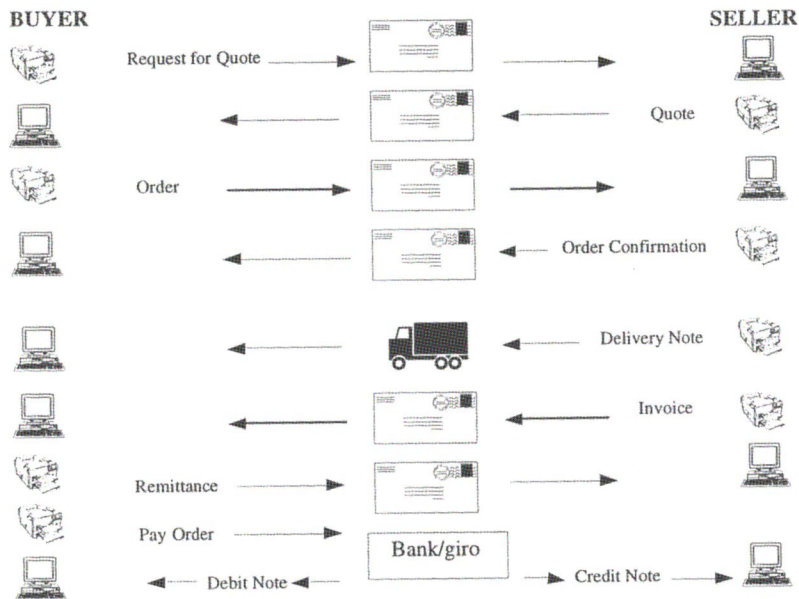


Fig. 1. Pre-EDI transactions.

Based on the quotations received the customer selects a supplier (or more than one) for this specific subcontract. Again this process is a mixture of calculation and subjective judgement. The customer sends orders to the chosen supplier(s).

In some industries an order confirmation is returned, stating the supplier's promise to fulfil the order, perhaps with minor changes.

Based on a computer generated list, the goods are picked from the supplier's warehouse. When the goods are shipped, the physical delivery is accompanied by a delivery note. Upon arrival, the customer checks the physical delivery against the delivery note to detect any discrepancies in quantity, quality etc. This is followed by a reconciliation of the actual delivery with the order sent earlier.

Later an invoice is sent from the supplier to the customer. This invoice can include several deliveries. The customer reconciles the invoice against the delivery and issues a payment instruction to her financial institution or sends a cheque. A remittance note stating what the payment covers follows the payment.

This exchange of information is very common in all kinds of supplier - customer relationships, in some industries with fewer and simpler documents, in others with more elaborate information. In most cases a number of DP applications are involved on each side. This means that the same data are registered on both sides of the transaction, independently of each other.

Data are not only keyed in, they are also verified, checked for inconsistencies, and often negotiated with the other party for clarification. If for example a supplier is out of stock on a specific product, he may offer an alternative etc. On each side there is a considerable reuse of data from earlier parts of the cycle. An order is stored for later reconciliation and so on. BUT data are keyed independently in each company, which opens up for keying errors, erroneous interpretations etc.

### 1.3 How trading could be done

Figure 2 shows the same chain of transactions with the use of EDI. Once the data have been keyed into one computer, they travel forth and back. Only changes and additional information are keyed.

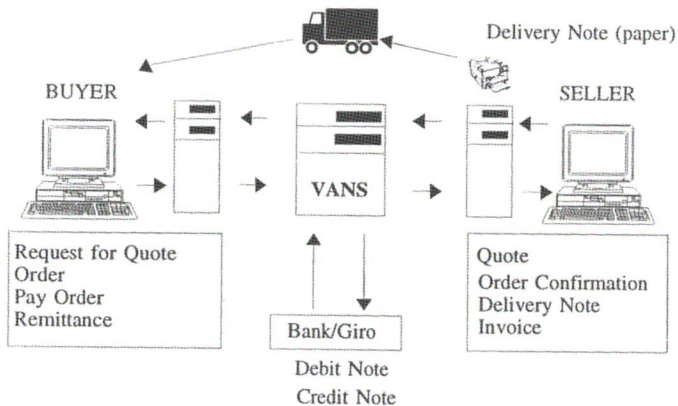


Fig. 2. EDI transactions.

Some parts of the trade cycle remain unchanged. It starts with the customer's stock control system. Based on a forecast, an estimated shortage of certain products leads to an automatic request for a quotation to a number of pre-select-

ed suppliers. The suppliers' quotation systems calculate an offer and present the data to a sales representative. After necessary amendments, the quotation is sent via EDI. The customer's ordering systems present the received quotations to a purchaser and a supplier is selected. From then on all administrative procedures are automatic.

The order is sent via EDI and the suppliers' stock control system reserves the goods for delivery on the specified dates. After the necessary reservations have been made, an order confirmation is returned. A provisional booking is sent to the freight forwarder via EDI. A few days before delivery, a firm booking is sent for all deliveries to be made on that day.

On the specified date a list of goods is printed in the warehouse. When the goods have been packed, each package will have a bar code label attached to it. A delivery note stating the actual goods delivered and data on packages and bar codes are sent directly to the customer, where a list of storage locations of the items is printed shortly before the consignment arrives. Upon arrival the label on each package is scanned and the stock levels are updated. Physical control of received goods can be made on a sample basis.

The invoice is generated and sent. (Actually, the invoice is no longer necessary. It does not add to the information in the two databases. It is merely a confirmation). After automatic reconciliation, the financial system generates a payment order to the bank and sends a remittance note to the supplier, stating what the payment covers. The banks system sends debit and credit notes to the two financial systems.

Apart from the subjective evaluations made before sending quotes or selecting suppliers, the only manual handling involved is the physical handling of the goods. For the construction industry this description of an automated trade cycle is premature, but it has been daily practice in other industries, like the automotive industry, for some years.

If we compare the previous traditional manual handling with the state of the art of technology usage, it becomes clear that EDI is by no means the only, and often not even the most important, change in information technology. On the other hand, EDI plays an important role by making intense and fast communication possible.

In the centre of Figure 2 is a large computer. It illustrates a Value Added Network Supplier (VANS). Some large companies transfer data directly between them, but this can be cumbersome with a large number of trading partners, especially because there is no general agreement on protocols, line speeds etc. Therefore independent network providers most often act as intermediaries. The most common arguments for this are:

- Each company only requires one line and one technical protocol. Protocol translations are handled by the VANS.

- Trading partners' applications can act asynchronously, i.e. a mailbox is part of the services and it can be filled and emptied at will.
- In case of disagreement, the VANS could deliver information on what actually happened.

#### 1.4 Definition of EDI

The definition of EDI used here is based on the use of the concept as formulated by the United Nations Economic Commission of Europe:

EDI (electronic data interchange) is the electronic transfer from computer to computer of commercial or administrative transactions using an agreed standard to structure the transaction or message data [and]...between independent computerised systems.

*(Introduction to UN/EDIFACT, UN/EDIFACT Rapporteurs' teams, Sept. 1990.)*

Although EDI often replaces traditional paper based documents, the term 'documents' is normally never used. The legal understanding of the word varies from country to country, so the EDI terminology uses the more neutral word: 'message'.

The definition above is about commercial or administrative transactions. The basis of such transactions is both formalised information, often on well defined documents, and informal information. EDI is only concerned with the former, i.e. those parts of a transaction which have been structured for many years and for which there are defined entities to transmit.

It includes such messages as invoices, customs clearance, container arrival notice, dangerous goods notification, insurance premium payment instruction etc.

Formalised information can be exchanged electronically via EDI, informal information via E-mail. The difference lies in the structure of the contents. E-mail is just an envelope in which you can send any kind of information (including EDI messages), whereas EDI requires structuring of the contents.

As normally defined today, EDI only concerns business transactions in textual format. Several companies also exchange other transactions like digitised pictures, CAD files etc., but they are not included in the concept as used in this article.

According to the definition, the DP systems on both sides of the transaction are independent of each other, i.e. the message standard is the only interface between the applications. It is important to note that independent applications are developed, maintained and run by independent organisational units. This does not imply legal/ownership independence. The organisational procedures and organisational structure have adapted, during the lifetime of the organisation, to the particular needs of the business. So the result is a large variation in trade practices, work routines and data definitions.

For many years, systems development has had one goal: To construct systems that best solve the individual organisation's needs. Only in recent years has there been a move towards standard packages, partly because they have become quite flexible. Together with the design of applications, the user interface and the work tasks surrounding these applications have developed accordingly.

In a traditional manual exchange of data, flexible humans are used as interface between applications, whereas, when EDI is used, applications and the associated working procedures use a standard as an interface between applications. Applications produce their output in an internal layout which is converted to the agreed standard and then transmitted. The receiver converts the received message to an internal layout before using the data in the applications. This conversion is normally done by standard packages. Conversion only changes format and layout, not the content.

Independence also implies potential conflict on important issues such as purpose of transactions, interests in the distribution of cost etc. Since there is no formal hierarchy to refer to, conflicts must be resolved via negotiations. Power relations between trading partners will often play a major role in implementing EDI and establishing the necessary definitions. If the partners are equal in power, these negotiations must involve lots and lots of detail, which often makes EDI projects time consuming. A large company with perhaps hundreds of trading partners cannot negotiate with them all so they often dictate conditions for trade to their suppliers. The nick name for such a relationship is 'Hub and Spoke' with the big company as the centre of a wheel.

The definition also includes two other important issues:

- Transfer between computers, i.e. there is no human intervention. This is discussed more thoroughly in Section 3.
- Data are defined and structured according to an agreed standard. This is discussed in Section 3.

## 2. Empirical evidence and discussion

The advantages and disadvantages of EDI have been discussed by several authors (e.g. Pfeiffer 1992 and Emmelhainz 1990). Some descriptions are based on surveys (e.g. TEDIS 1991), while others rely on qualitative judgement (e.g. Scala & McGrath 1993).

### 2.1 Why use EDI

Most authors argue from a management perspective. The most frequent arguments for using EDI are:

- Reduced labour cost through reduced volume of data entries.
- Improved accuracy of data and fewer errors.
- Increased speed of transmission.

At a second level comes a number of arguments relating to how EDI is used:

- Reduced inventory.
- Enhanced relationship with trading partners.
- Improved productivity.
- Standardisation of procedures.

On the negative side are arguments like

- Lack of a common understanding of implementing EDI.
- High initial capital expense.
- High volume necessary to attain benefits.
- Standards are still in a state of change.

The various sources differ in their ranking of the importance of the advantages and disadvantages, but they all list the same arguments. Some of the advantages are direct, like the three mentioned above. Others, as illustrated in the example above, rely heavily on the implementation of companion systems that automate hitherto manual practices. It is this type of arguments that are used to substantiate the high cost of EDI.

These arguments will not be discussed directly any further.

## 2.2. Hype versus reality: Hubs versus Spokes

Publicised literature on the use of EDI reveals two major elements:

- A long row of success stories, stressing the strategic importance of EDI (e.g. Foerster 1991, Buzzel 1985, Jeffries 1989, Van den Bragt 1989). Most of this literature on EDI is based on cases (some of which merely offer anecdotal evidence), and generalisation is difficult. The cases mostly describe large, often multinational companies with many suppliers and their usage of EDI. Now and then the cases also reveal how the trading partners have benefited from EDI.
- Despite these apparent successes, the use of EDI is still moderate and to some extent experimental. Pfeiffer (1992: 112) shows a summary of the number of EDI users with only a few tens of thousands EDI users world-wide currently. He concludes that EDI is still at a rather embryonic stage, especially outside the US and the UK. According to Barber

(1991), the vast majority of US companies remain in the early stages of EDI planning and implementation.

Furthermore, as Pfeiffer (1992) notes: Some of the perceived benefits are not necessarily dependent upon EDI, but often stem from internal reorganisation induced by EDI. This aspect will be discussed later in more detail.

Lately more thorough investigations have been conducted.

Benjamin et al. (1990) discuss 4 cases of EDI and IOS and they conclude that the most significant factor in determining the effective use of EDI is the organisation's ability to manage the changes of structure and work process that must accompany the implementation of this technology. According to them, the effective use of EDI requires that organisational redesign must become synonymous with EDI development. They find that this factor has been overlooked in previous research.

Bergeron and Raymond (1992) conclude from a survey with answers from 140 Canadian enterprises (response rate 25%) that realising the promises from EDI is neither automatic nor easily achieved. Many firms indicate in their sample that they have not benefited from implementing EDI, and some firms even state that they have in fact been disadvantaged by it. The more successful firms are those that have made EDI a more integral part of their business operations, management and strategy. Apparently EDI can only be applied with a sufficient level of integration through a fundamental rethinking of how the organisation does business.

Pfeiffer's survey (1992) included 128 respondents from all over Europe, a response rate of 19%. In this connection it is interesting to note that the use of EDI is not perceived as having had a positive effect on cost of transactions, nor on lowering inventory levels. (p. 193)

Pfeiffer's survey cannot confirm that the adoption of EDI is expected to induce modifications in organisational structure. For organisational processes, he finds that implementing EDI is followed by changes in medium sized and large organisations. Bergeron and Raymond find that integration, both internally and externally, is a determining factor in achieving strategic benefits from EDI.

The success stories mentioned in the beginning of this paragraph all describe companies that rearranged their way of doing business and where EDI was part of this reorganisation. So one could argue that the success stories merely omit part of the story, namely those unfortunate trading partners that are included in the work of Benjamin et al., Bergeron & Raymond and Pfeiffer. With the results above in mind, an interesting hypothesis could be that hubs reorganise to benefit from EDI, and spokes do so to a lesser extent.

In Bergeron and Raymond (1992) 64% of the respondents reported that EDI was imposed upon them by one or more of their business partners. Pfeiffer similarly found that small and medium-sized enterprises tend to adopt EDI reac-

tively and that they do not conduct a cost benefit analysis before the adoption of EDI.

Unfortunately, neither of the two surveys tests their hypothesis against proactive versus reactive implementation, so we do not know if proactive implementation is followed by strong integration.

The surveys indicate that there are serious problems, especially with small and medium sized companies, which have been more or less forced to introduce EDI. The rest of the article will focus on a deeper understanding of the implementation of EDI to get a better knowledge of the technical and organisational processes arising from such an implementation.

### 3. Semiotics and the purpose of EDI

In order to analyse the possible consequences of EDI, I have chosen to view EDI as more than a technical exchange of data. I shall view EDI as communication between organisations and I shall use semiotics as the theoretical base for further analysis.

#### 3.1 EDI seen as a speech act

According to Searle (1977) the basic unit of linguistic communication is the speech act: The production or issuance of a sign or word or sentence. When a receiver accepts something as an instance of linguistic communication, a speech act, it is because the receiver differentiates it from noise assuming that it is produced with a certain kind of intention. Searle (1979) further classified speech acts into five categories according to their intentions. One of these categories is particularly important with respect to EDI: Directives, which is an attempt to get the receiver to do something.

This fits very well with Simons' (1957: 154) description of communication within and between organisations:

Communication may be formally defined as any process whereby decisional premises are transmitted from one member of an organization to another. *(Simons 1957: 154)*

Simon discusses communication between individuals/groups of persons and he discusses various conditions for facilitating communication for the purpose of decision making. The primary purpose of Simon's communication is to solve problems and the decisions should eventually let some individual act according to the intended meaning of the message sent.

Winograd and Flores (1986) also emphasise the action aspect of language. We use language to do something, to convince the listener to act.



The purpose of EDI can be seen in the same way, only it concerns communication between application programs. The intention behind the sending application's message is to get the receiver's application to perform a specific function.

### 3.2 Semiotic description of EDI

The following brief description of semiotics in relation to EDI is based on Morris (1969) and Stamper (1987).

*Syntactics* deals with the formal relation of signs to one another. It includes the structure of signs regardless of how they are used or what they mean.

To clarify syntactics in relation to EDI, I have chosen to split the syntactical dimension into two levels:

- *The technical level of syntactics:* Basically, all electronic communication consists of electrical or optical signals. The basic problem is to make sure that when a sender converts a sign, e.g. a character, to such signals, the receiver can reverse the process and replicate exactly the same character. The technical level involves very complicated issues, but is of no relevance for the topic of the article and will not be dealt with any further.
- *The character part of syntactics:* This level deals with the syntax of EDI messages: The relations between characters, i.e. presentation of characters, sequencing of characters, delimiters between characters or groups of characters etc.

*Semantics* generally deals with the relation of signs to the objects to which the signs are applicable. A sign has a semantic dimension if there are semantic rules, formulated or not, that determine its applicability to certain situations under certain conditions. To communicate effectively, the parties involved must agree on these rules. This consensus is often culturally based and implicit. As soon as there is a conflict about the interpretation of the signs sent, this consensus is threatened.

In relation to communication between computers, this consensus has to be very formalised and strict because it must be programmed. Therefore the establishment of consensus can be a cumbersome process if many parties are involved. An example: Through tradition, legal rules etc., there is a long established consensus about the meaning of the designatum 'invoice', whereas there is no consensus about the detailed contents of a specific invoice. In order to exchange invoices via EDI, there has to be consensus on the semantics of each specific invoice exchanged.

*Pragmatics* generally deals with the relation of signs to their interpreters. Part of this discipline deals with the intention behind the signs and the effect of the signs on the interpreter: Will the communication make the receiving party understand the sender's intention with the message? This is more than the meaning of the message. The semantic value of a string of signs can be an invoice. The intention of sending the invoice is to make the receiver pay the stated amount.

In relation to EDI, pragmatics deals not only with the function of the programs that send or receive messages, but also with programs that generate those messages and programs that take action upon receipt of an EDI message.

This classification into three dimensions is not clear-cut. They invade each other. This paper will focus on the semantic and pragmatic dimensions and especially on showing that to a large extent, pragmatics determines semantics in EDI, but also that semantics can control the actions taken upon an EDI message. It is my intention to show that pragmatics is underestimated and that the real hindrance to the growth of EDI usage is a lack of understanding of the pragmatic dimension of automating communication.

### 3.3 Who is the interpreter?

This is the first question to be answered when semiotics are used to analyse EDI. Are the computers (or the programs) which generate and receive EDI messages interpreters themselves? If so, how do they 'decide' upon an interpretant?

Referring to an organisation's general use of computers, Ronald Stamper (1987: 44) states that an arrangement of computers does not in itself constitute an information system. It only operates on signs that are intrinsically meaningless.

Meanings are only conferred upon the symbols manipulated by the computers when they are interpreted by the social system within which the technical system is embedded.

*(Stamper 1987: 44)*

In this discussion he makes a clear distinction between the technical and the social systems.

In the case of EDI, this direct interpretation by a social system is not performed on each set of signs constituting an EDI message. One computer can generate EDI messages, e.g. orders, send them to another computer, which generates and sends an order confirmation, instructs robots to remove goods from a warehouse and pack it for shipment, and finally generates and sends an invoice. The first computer receives both the order confirmation and the invoice and takes action upon it, partly by sending a payment instruction to a bank's computer, which in turn debits and credits the relevant accounts. Under normal conditions humans are involved in such a set of transactions by doing some of the