Designing Enterprise Information Systems – the semiotic approach

Ângela Lacerda Nobre
Escola Superior de Ciências Empresariais do Instituto Politécnico de Setúbal
anobre@esce.ips.pt

Abstract
The present article reviews the work of R. Stamper and his research group on organisational semiotics and presents the resulting information system management model - the organisational morphology model. Semiotics, as the theory that studies signs, defines organisations as information systems and studies them through this particular perspective. The morphology model is an illustration of a possible application of organisational semiotics to information systems’ analysis and design. This model is used to re-engineer the effectiveness of key work processes, as opposed to the smaller efficiency gains of usual automation processes (K. Liu et al, 1997). The critical aspect of this approach is that it is able to link both the human and the technological aspects of information systems, and that is crucial to the design of enterprise information systems that serve real and complex business needs.

Key-words: information systems, business strategy, semiotics and re-engineering

1. Introduction

«Though we name the things we know, we do not necessarily know them because we name them.»

Homer W. Smith

The rate of change of today’s society is often referred as one of its key characteristics. This change is present in several aspects that are less obvious or that may have more subtle consequences. One of them, is the way scientific theories are interpreted. In the past, one theory would be valid until another and better theory would take its place. Today, each theory has a validity that is intrinsically dynamic, i.e., though being accepted as valid it is constantly being questioned, in a positive way. Theories try to picture reality, and reality’s complexity and dynamism imply that scientific theory has to be interpreted in that same framework of constant and complex evolution.

This view is particularly attractive for case study analysis as when facing a real context it is important to have a flexible and open standpoint. This particular article, though not applying a specific model, relies in a set of studies (Stamper, 1996) and in a model for analysis and design of enterprise information systems – the organisational morphology model (K. Liu, R. Stamper and K. Huang, 1997).
Several authors focus on the importance of considering «people» in management issues and practices, as an implicit criticism towards the excessive technicism which surveys the current way of analysing organisations. As if we were not posing the right questions or were looking for answers in a wrong way. D. Williams (1999), refers a long list of such misconceptions, like companies referring that employees’ motivation is important without even considering what motivates them as individuals, as persons. In an information system context, it is particularly relevant to consider the technological bias that dominates most approaches.

P. McKeown and R. Leitch (1992), focusing information systems that support strategic decision making, refer that people and the way work processes are organised are elements of the information system, together with the hardware – process technology – the software – product technology – and the data and information itself – the product.

The next sub-chapter is an adaptation of an article by Ronald Stamper (1999) with an extensive critical approach to current forms of system analysis and design.

**Part I – An introduction to R. Stamper Organisational Semiotics - an information system management model**

2. 1. A semiotics approach to organisations

Ronald Stamper (1999), in a leading and enlightening article on «New directions for systems analysis and design», refers:

> Information systems analysis and design is stagnant as an academic discipline. It exists largely as an adjunct to software engineering to facilitate the application of computers.

However, to judge by the numbers of systems that fail because requirements are inadequately specified, it is failing in its practical role also. (...) In fact we perform poorly. A high proportion of computer-based systems fail. Estimates vary around 40-50% of projects. They fail not for technical reasons but because the systems do not adequately serve the organisation. This indicates that the requirements are often wrong (...).

Before indicating a new direction for practice and research in information systems, let me explain why I think it is necessary. I start from the premise that organised behaviour is the same as getting things done by using information. Our practical job is to make this
easier and more effective, with or without any specific technology. Our academic job is to build and test theories that deepen our understanding of organised behaviour, both from its own sake but also so to improve our practical work by developing better methods and techniques.

This author has had a crucial role in the development of pioneer work in the area of information systems analysis and design, namely through the use of semiotics as a conceptual framework for organisational analysis (Stamper, 1973, 1980, 1985, 1993, 1996).

Semiotics, as a science of signs (Pierce, 1931/35, Morris, 1946), offers a useful way of analysing organisations (Liu et al, 1997). Conventional organisational theories (e.g. Mintzberg, 1979) explain how people, within a firm, are organised within a certain structure so that responsibilities and tasks derived from the organisational objectives are assigned to them. The semiotic view, however, helps to understand organisations and their behaviour from a different angle, which may be more suitable for the purposes of systems analysis and design, especially in a re-engineering context as will be developed in the next sub-chapter. From the semiotic approach, the organisation is seen as an information system. This information system has two essential elements, the agents and their actions. The agents, in an organisation, act purposefully according to some pre-defined goals.

Semiotics uses this two elements of an organisation – agents and their actions – in order to develop a network of relationships that clarify the areas where improvement is possible, both by reviewing work processes and flows and by the use of technology and automatisation of proceedings.

More than trying to improve the efficiency of the information system – human and computational – it aims at enhancing the effectiveness of the organisation as a whole. More than improving performance in terms of achieving the organisations objectives, it does so in an optimal way, with the least possible costs, or with the best cost-benefit solutions.

In the context of computational applications, like the use of information systems in organisations, the requirements specifications area is critical for the success of the final result. Sometimes requirements analysis is incomplete but even when it is correct, specifications of the application are so large, complex and impenetrable that users cannot exercise their legitimate control over the systems built to meet their needs. In the case of companies out-sourcing its information technology solutions, this barrier makes it impossible to formulate a water-tight contract, thus leaving the client vulnerable.
Stamper (1999) insists on the need to focus on the challenging aspects of information systems as a science, such as: (i) ensuring, for the people who use the information, that it is meaningful; (ii) making explicit the intentions behind the messages they handle; (iii) also making explicit where the responsibility for the information resides and (iv) establishing what social effects, such as shared understanding, mutual commitments, acceptance of common goals, and so on, which the information must produce, if it is to have any value at all.

These aspects, which are of greatest importance to the users, receive hardly any attention in the present methods for systems analysis and design. This author examines the assumptions, especially the tacit assumptions, behind current theory and practice as these tend to govern the way we think.

2. The orthodox perspective on information systems – the information flow

The orthodox view, according to Stamper (1999), is that we conduct information systems analysis and design in order to build computer-based systems, based on information flows. The unorthodox view, is that organisations are the real information system, and in them, computers may or may not have a useful role to play. This author was conscious of this distinction since the sixties and refers that, since then, little has changed as the computer still dominates our thinking. In 1995, the UK Academy of Information Systems, defined the discipline to include the strategic and managerial aspects but still characterises the purpose of information systems as «the gathering, processing, storing, distributing and use of information». These symbol-manipulating functions always seem to make the computer central to the study of information systems. Today, this information flow paradigm (italics in the original work) dominates our thinking and accounts for our difficulty in finding new directions. It is the natural product of working with computers, because the functions of information systems listed in this definition are just those for which computers are designed. Software engineering has to begin with a specification of ‘informational requirements’ and the most natural way of doing this is to characterise the surrounding organisation in terms of patterns of information flow, as though it were an extension to the computer.

The theoretical ideas, which guide most information systems analysis and design work and underpin the techniques we employ, all derive from the information flow paradigm. These fundamental notions have scarcely advanced since the sixties and they persist in making us think with a technical bias.
This author proposes lateral thinking as a way to find more confident responses to the discipline’s apparent dead-end. Most answers, such as ‘method engineering’ - a way of developing and combining a variety of techniques of systems analysis and design - are too expensive and unpractical; an academic ambition born of a lack of appreciation for the problems of organising people.

3. Positivism and semantic analysis

To escape from the flow paradigm it is difficult, comments Stamper (1999). To apply computers, one needs logically precise techniques, which we certainly can achieve with models of flows. Any alternative must be equally precise, though it would be better to serve the information users before the information manipulators (italics in the original work).

Examining the current methods more closely, one finds that their precision is tacitly underpinned by the assumptions of positivism. This philosophical stance dismisses as meaningless all sentences except statements of fact, which obtain their meanings by representing features of an objective reality. Positivism is out of favour in the present, post-modernist world, but it still dominated this discipline. Indeed, on examining the literature of information systems, Orlikowski and Baroudi (1991) found that 97% could be classified as positivist. Almost without exception, we find that the data modelling methods we use today, as well as the various schemas used in artificial intelligence, are based on positivist ideas.

Escape from positivism is impossible unless we are prepared to question its implicit ontology, that deep, tacit assumption about the nature of what exists. Positivism implies that we trust, absolutely, that there exists an objective world on which we all gaze, comprehending or not, filled with nameable things, whose individuality and identity are fixed, quite independently of any observer. According to this view, the databases we design are ways of picturing this objective reality.

Objectivism is one of several other ontologies, favoured in the information systems and computing fields, none of which hinders the use of mathematical formalisms. Conceptualism, on the other hand, treats meanings as references to concepts in people’s minds, and the ‘conceptual schema’ is inspired by this view. Nominalism, which treats one word or expression as meaning some other word or expression, is adequate for computer scientists and others whose job is to transform one lot of data into another. Most of us, when we do mathematics, adopt yet another ontology, that of platonic realism, where we imagine that our symbols refer to a world of ideal triangles and circles, the kind of mystical, heavenly purity that Plato describes in his
dialogue, *The Republic* (italics in the original work). However, the best ontology, according to Stamper, is one that assumes that people collectively construct their world.

Escape from objectivism and its more dubious companions, is difficult but possible. One famous escapee, referred by Stamper, was Wittgenstein, an arch positivist in his *Tractatus* (1921) who adopted a quite different ontology in his *Philosophical Investigations* (1953). Instead, he proposed that words acquire their meanings in the contexts of the ‘language games’ people play in getting practical things done with the help of language. He was one of many who saw that meanings are somehow socially constructed. Unfortunately, it is not at all clear how this idea can provide the kind of precise theory we need.

4. Mechanistic versus organisational models

While around 97% of our literature is positivist, the other 3% belongs to writers who have either a background in social sciences or have learned the hard way that organisations do not behave like computers. They share a sense of unease about mechanistic models of information systems promoted by the flow paradigm, combined with positivism and objectivism ontology. Their alternative perspective acknowledges the intrinsic ambiguity and complexity of organisations where power and politics make nonsense of any claim that we can make objective observations of information systems from which requirements can be deduced. Stamper raises the challenging question: «*Can we possibly imbue the orthodox techniques of the 97% of the literature with the wisdom in the 3%?*»

This author refers that these two distinct subcultures are often nicknamed as ‘hard’ or ‘dry’ outlook, on one hand, and on the other, the ‘soft’ or ‘wet’ look – the orthodox and the unorthodox, or organisational view of information systems (‘The dry and the wet’, by Goguen, in Falkenburg et al, 1992).

This rich, soft view of organisations helps the practising system analyst up to a point. That point is reached when one is forced to be logically precise and detailed instating what the software engineers must deliver. Before that stage, a range of techniques can increase the analysts’ awareness of the inconsistent objectives of rival groups, the subjectivity of their knowledge and its relationships with their value systems. If they do no more than provide glimpses into the richness, complexity and fluidity of organisational reality, these techniques sharpen the analysts’ perceptions and heighten their sensitivity to some of the problems that cause systems to fail when technology is arrogantly imposed in a mechanistic fashion.
The writing of this other school acknowledges the inadequacy of any single approach, encouraging the use of a diversity of techniques with varied strengths and weaknesses. Some of its members have made fine contributions to the exploration of the philosophical issues affecting this discipline and they are engaged in the search for extensions to our formal method into the organisational domain (Hirshheim et al, 1995).

Between the hard and soft communities of thought there exists a deep antipathy, which is not at all surprising. The hard-and-dry side, quite rightly, say that they cannot launch a software engineering project on the basis of the kind of analysis produced by any soft-and-wet techniques. Of course no one doubts that the deeper our understanding of all critical aspects of an organisation, the more likely are we to create new systems that meet the needs of users and to implement them with sensitivity. The challenge is to find ways of supporting the ordinary, practising analyst so that he or she can give due weight to the many complexities and ambiguities of the organisations where computers are to be applied. Without such instruments of analysis, these aspects of the problem will be given little weight in system design, and they will remain hidden in the smaller, academic part of our professional literature, and good technical systems will continue to fail for organisational reasons.

With equal validity, it can be argued that the hard-and-dry, mechanistic models offer only a procrustean bed into which the real organisation cannot fit without crippling distortion. They justifiably point out that the high failure rate, for even technically sound systems, is caused by organisational issues being given scant attention. The challenge is to create techniques and tools that are both formal and precise enough to enable the systems engineering work to be specified accurately, while, at the same time, allowing, and if possible encouraging, the analysis of the relevant human, social and organisational complexities.

**5. The research problem and the method**

There is a gap between two important sides of our technical knowledge and competence, Stamper continues. On one side stand the majority of practising systems analysts: they are committed to building computer applications, on the basis that organisations function in much the same way as computers, by gathering, storing, processing and distributing information. They use formal methods that state precisely what the machines should do, and they produce technically sound systems, which then fail in organisational terms. On the other side, stand a small group, with a relatively academic bias, who can provide illuminating, discursive interpretations of the subtleties of organisational behaviour, which cannot be incorporated into
the kinds of formal specifications that software engineers require. We really need both kinds of expertise.

The challenge is to find a formal and precise way to describe organisational behaviour that does not force the user to distort the picture. Better still, such technique should help the analyst to explore any relevant organisational problems and express their solutions in the analysis of information requirements.

According to Stamper, several authors have developed different methods and theories to analyse specific organisational issues, such as power structures (Foucault, 1979), the various cultural groups within organisations (Young, 1989), their metaphors (Morgan, 1986), the problems related with creating the conditions for free and open discussion (Habermas, 1984/87) and to secure the participation of system users, as well as to secure the legitimisation of solutions (Mumford, 1983).

To build a bridge between the two sides – the wet-and-soft and the dry-and hard perspectives – we must abandon our familiar hidden assumptions about the nature of reality, in favour of an ontology that recognises that we can only know a socially constructed reality. Then, we must discover how to handle this new ontology in a formal, precise language suitable for specifying requirements for software.

The trouble with our tacit assumptions, according to Stamper, is that they guide our thinking without our realising what is happening. The issue is that accepting that the world, as we know it, is socially constructed, does not prevent our being formal and precise. With the goal of identifying ‘the accurate description of organisations’, a set of researchers, including Stamper, in the early seventies, conceived an organisation as a system of social norms. Their first research objective was, then, to devise a formalism in which these norms could be expressed precisely enough to enable them to be interpreted by a computer. So they devised a series of legally oriented languages, versions of Legol, testing them against problems of increased difficulty. What they were searching for were the structures that had been discovered by the intuition of law-makers over the past 3,000 years, ideas that had not yet been formalised. In other words, they were trying to find the solid ground on which to set the organisational side of the bridge.

At the same time, scientists interested in computers and law were formalising legal norms using established forms of logic. They started with the assumptions that predicate logic and its extensions would be adequate for representing legal norms, thus building solid foundations based on a body of well-established knowledge and techniques. But they made it almost impossible for themselves to escape from the conventional, objectivist assumptions about the
relationships between information and reality. The kinds of logic they use are rooted in mathematics and the natural sciences, which deal with the worlds of timeless reality for which no one is responsible and where meanings are established, without human intervention, by some mathematical, semantical mapping from symbol to reality that appears from nowhere. A bridge built from the mechanistic bank, without regard for the human and social issues, will hang incomplete over the gulf, unable to transport ideas from the organisational side into the design of the formal system.

According to this author, for anyone doing research on organisational information systems, one thing is sure, legal norms provide us with an excellent source of empirical material. They are extremely complex and through them we can see all parts and processes of information systems exposed to public scrutiny and functioning in slow motion. In a business or administrative setting, these rules, in most cases, have been devised with great care. This legal and formal structures have evolved in five millennia of law making. As far as everyday concepts are concerned, they are the products of many thousand of years of social evolution that collectively make up our culture. Their familiarity makes them seem objective. Different cultures draw boundaries slightly differently and they pass on the results of their endless discoveries and negotiations to each succeeding generation of children. This ontology of a socially constructed reality is well suited to the study of organisations, though it also can apply to the computer, hence its potential for building a bridge between the organisational information system and the computer. This is the core idea behind this model of information systems analysis and design that incorporates both the human and the computational sides of an organisation.

The main results of this research developed by Stamper and his colleagues was that the initial intuition, that an organisation can be represented by the legal, and other norms that its members strive to follow, proved to be successful. There are many layers of norms, which are like the programs for a computer, but they program human activities. Their interpretation is not always uniform or completely reliable. However, departure from any one layer is likely to bring into play norms of another layer that steer people back towards the straight and narrow path of conformity. Some slack always remains in the system, which enables it to innovate and explore new ways of behaving. The complexity is enormous and never capable of being fully explicated in an information requirement specification.

The complexity is no problem, according to Stamper, as we can always rely on the human system to store and apply any norms that are too complex for the computer system. For example, in health insurance system, to decide when a person is no longer sick, we avoid the impossible task of specifying a computer programme, by calling a qualified medicat
practitioner, who will have spent eight or ten years acquiring the necessary norms, to exercise them for us. There is no point in mechanising those parts of the system where the norms are prohibitively expensive to analyse. Instead, all we need to do is to be clear, and where possible, formal, about the relationship between the computer-based and the human components of the information system. We do this by recording which agent has the authority to supply the relevant norms.

By placing emphasis on the norms, we put the social and computer components into a unified picture. The norm exist to enable us, the participants of organisations, to cooperate through shared understanding and mutual commitments. The computers are simply tools through which we communicate. Everything computers do remains the responsibility of people, and therein lies the essential distinction between the human and the machine components of the system (italics in the original work).

The tendency to treat computers as agents, a common attitude in the artificial intelligence community, must be strenuously resisted because machines are never responsible. The bridge we are attempting to build must stand, on the organisational side, upon the shoulders of the people responsible for the information and knowledge employed in the system. We can, and should, treat the information system as the human, social systems for which the computer-based system is just a prosthesis, a crutch to our memories or an amplifier for our voices, a ‘Zimmer-frame’ for an arthritic organisation – comments Stamper.

6. The field paradigm

So far, nothing has been said about information requirements. The reason is that the norms take precedence over the information. They form the kernel of the organisation and they determine what information we need. This observation yields a radically new way of specifying information systems, one based on a field paradigm (italics in the original work).

The fields in question are fields of norms shared by groups of people. When an individual is acting as a member of a group, then its field of norms governs their behaviour. One individual can be under the influence of more than one field at any time – family, company, sports club, profession, religious community, and so on – fields that pull their subjects in contrary directions.

Despite their complexity and possible contradictions, all the norms have a similar structure and all the information required by the organisation will be a logical consequence of the norms that define it. Most of the norms will require the interpretation by the human subject, but a few can
be applied mechanically, and these, and no others, we may choose to allocate to the computer subsystem.

It is as though we construct norm systems as fields of force that bind people together in a structure of inter-linking groups. The norms have to be installed in the minds of people. Information, or signs, as Stamper prefers to think of them, then links these norms together.

We may have many different kinds of norms, like behavioural norms, cognitive norms, and perceptual norms. Science and engineering are predominantly bodies of cognitive norms. Most of the common perceptual norms that apply to the ordinary world around us are learned in childhood and are expressed by our ability to use words correctly. One reason for objectivism seeming to be incontrovertible is that we learn to recognise objects and name them so early in life that it seem strange to think of them as repertoires of behaviour. However, this author comments, if we watch a very small child getting acquainted with a new object, she will do so by testing out all the things it permits her to do.

A point worth noting is that norms that have no conditional component are simply attitudes. Thus knowledge about particular things we express as attitudes. We can define ‘knowledge’ quite precisely in terms of norms and attitudes. ‘Information’ and ‘knowledge’ are both dangerous words that our discipline bandies about as though their meanings were obvious, although they are used with confusing ambiguity. This author has written at length (Stamper, 1973, 1996) on the numerous precise meanings of ‘information’ based on the more reliable, primitive notion of a sign (commas and italics in the original work).

This author’s motivation for working on the meaning of ‘information’ is that no subject can be treated scientifically without first developing a precise and stable vocabulary. Without a precise language, we cannot formulate hypotheses capable of being rigorously tested. Vaguely formulated hypothesis are little better than rhetoric, which, this author suggests, is the standard of too much of our information systems literature.

The traditional, philosophical way of talking about knowledge is misleading for the study of information systems. If we only admit ‘justified, true belief’, then knowledge of anything but fact is excluded. However, the man-in-the-street, as opposed to the philosopher, is likely to use ‘knowledge’ in a broader sense. Perceptions of knowledge of what exists provide a foundation for the other kinds of knowledge, but, in their turn, perceptions depend on our using values to decide where the boundaries of things should be placed.
7. Knowledge defined

According to Stamper, information only yields knowledge when it produces knowledge as defined above. It allows us to perceive the world, to understand it, value it and know how to act within it. Information systems are the necessary mechanisms for making and using knowledge, including the process of justification. The quality of information and knowledge has to be tested in various ways, according to meta-norms such as those governing scientific method, proof in logic, legal processes and ethical principles.

One of the worst features of the information systems discipline as currently practised is its narrow concern with the efficiency of data processing and the competitive advantage or economic potential of information. Stamper refers that we are entering a society and economy based on information, as the key resource, and that this discipline has a key role to play in establishing and maintaining the quality of information and knowledge in everyday life. Of course, the philosophers of scientific method, the logicians, experts on jurisprudence and ethics will be the ‘legislators’ who advise on the meta-norms for the quality of information and knowledge in their respective fields. However, there currently exists no profession concerned with translating their insights into well-designed information systems that use technology efficiently and also deliver information and knowledge of high quality.

A crucial contribution of Stamper’s work and of other researchers of the same school of thought is their critical position in relation to the usual concerns of software engineers. They refer the need for an urgent reform in this discipline and its profession. Software engineers look after data-processing efficiency. Though still responsible for specifying what data should be processed and how, information systems analysts and designers should be concerned primarily with effectiveness and quality. The difference between the emphasis on efficiency or effectiveness is well illustrated in a re-engineering example cited in the next section. Efficiency, as the effort to produce the same output with less means or, alternatively, to produce more output with the same means, as is more often the case, in terms of internal business policies, is a very narrow and limited approach to organisational restructuring. It is essential and it is important but it is not enough. Only complemented by effectiveness measures may efficiency related efforts be used to restructure and re-engineer an organisation. Effectiveness relates to the degree by which the objectives are attained. Though the two notions are complementary, in most situations, they may also be substitutive, in special circumstances. If we reach the organisations objectives by 70% and want to increase that performance to 90%, that may not be possible without loosing some degree of efficiency, as more resource consumption may be necessary.
8. Concluding remarks on the semiotic approach

In the research programme developed by Stamper (for a first account, Stamper, 1985; for a fuller account, 1996), the model identified ‘affordances’, ‘ontological dependency’ charts and the constant interplay between signs – information – and norms – knowledge – in organised behaviour – information systems. By programming society, Stamper jokes, we can program computers by default. All the systems specifications, through this methodology, are meaningfully linked to the real world.

As a final commentary, this author refers that building information systems has been a roaring success as a strategy for selling computers, communication services and software. Great fortunes have been amassed. For the users of these technologies, the results have been patchy. Some undeniable successes have been accompanied by many undeniable failures. It is difficult to be more precise because we have no adequate means of measuring performance. Cost saving on the physical level is not a satisfactory indicator because we should also look at the value achieved at the social level, and we have as yet no satisfactory way of doing that. Too often we do not judge work on information systems analysis and design by the cost savings, let alone by the social value added, but by the rapid building of a computer system that works 'mechanically' (commas in the original work).

Stamper refers, in his final conclusions:

Certainly our discipline should continue to improve performance as the providers of the requirements specifications for building software but we should now raise our ambitions to include the social systems in which software and other information technologies play their parts.

I am proposing nothing less than the redefinition of our discipline as the study of how, in organisations and in society, we get things done through the use of information and the various forms of information technology. If it seems too broad a scope, it is not that I am suggesting we invade other disciplines on which it impinges, but to suggest that we recognise their relevance and learn from them. There are so many of these tangential disciplines to instruct us that we should never be short of refreshing new ideas. Linguistics, various branches of philosophy, anthropology, sociology, psychology, social psychology, law, economics, semiotics, as well as logic, mathematics, several branches of engineering are some of the territories whrer I have taken an occasional raiding party and returned enriched. Approached in this spirit of intellectual adventure, I don’t think there could be a more interesting and exciting discipline.
(...) Information systems, approached in the spirit I have outlined, leads to a formal treatment of society and its institutions by regarding them and modelling them as systems of inter-communicating social norms. This leads me to the conclusion that our discipline has an academic, indeed a scientific future as a formal branch of the social sciences.

At present, by treating our subject as a ‘front-end’ to software engineering, we narrow our sights too much. Software engineering has nothing to say about meanings, nor about the intentions behind data being processed, nor yet about anyone’s responsibilities, nor about the social value of systems or their justification in any way beyond their smooth ‘mechanical’ functioning. The new discipline of information systems, which I am proposing, must be concerned with all these extra issues. A small percentage of our literature does take this broader perspective. So I am not saying anything original, in that sense. What I am saying is that we can introduce into the broad, social perspective on information systems some of the formal rigour with which we are familiar from the computing side of our work, even in the treatment of meaning, intention, responsibility, social value and justification.

(...) I am very optimistic about the future of information systems, provided that it finds the confidence to cut loose from information technology. Moreover, when it later returns to look at information technology from this new perspective, it will do a much better practical job.

(...) The field paradigm leads to a theory of information systems as social systems in which technology can play a limited role. It transforms our discipline from an aid to computer application into a formal and precise study of organised behaviour with wide intellectual and practical implications. Our discipline will be able to underpin all kind of systematic organisational re-engineering, with or without the use of IT. It has the potential to augment the present broad-brush study of organisation with the precise scientific modelling.

In addition to helping to implementing technical systems to support organisational activity, our new analysis will also inaugurate the changes to the informal or cultural aspects of organisations. The norms we identify can be implemented in some cases with the aid of computers, but very often people are better or indispensable for implementing them. Our role will be that of organisational architects.

As architects of organisations, our task will not be to dictate the structures to be used, rather it will be to facilitate the evolution of patterns of organisation that best suit the
people involved. Too often today, we cram neat technical solutions down the throats of people who cannot digest them. In future, a vastly improved understanding of organisations as information systems will allow us to proceed with greater confidence and less arrogance. I make these statements in the light of our experience using the information techniques.

(…) Documentation is also changed. We have become so accustomed to the flow models for information functions that we want organisations to behave that way too. Surely it would be better to impose on the computing machinery the structures that are natural to organisations; this opposite tendency results from using the information field model. We find that the results are much easier for people to understand, even to the extent of reducing the documentation they need to as little as one twentieth of that generated by orthodox methods. This is the direction we want to go – putting the users more firmly in control of the technology.

(…) Until now, systems analysis and design has been concerned with putting computers into information systems for the sake of corporate efficiency. From now on, in my opinion, we also have a duty to put the concept of information back into information systems. If we do that, our systems are more likely to meet a wider range of society’s needs than simply the corporate accountant’s bottom line.

Part II – Organisational Morphology

1. Re-engineering with the organisational morphology model

K. Liu, R. Stamper and K. Huang (1997), have developed a conceptual framework and a theoretical model – the organisational morphology model - which places «people» at the centre of system’s analysis and design, thus avoiding the over simplifications of the technological bias. In this model, both human and computational parts of an information system are integrated.

Using a semiotic view of an organisation, that considers an organisation itself as an information system, they identify the agents and their actions as two essential elements of any organisation. According to this organisational morphology model, the agents have pre-defined goals and they act according to those goals. These actions or behaviours can be divided into three categories: (i) substantive behaviour, which is guided by tasks, assignments, rules and norms and that contribute to the goals of the organisation itself; (ii) communication behaviour, which consist in
message passing to support the substantive behaviour; (iii) and control behaviour, that assures that there are norms that guide each agent to act properly in performing the substantive tasks.

Each of these classifications is then subdivided again into a substantive, message passing and control element until the level of detail is sufficient for the purpose of the analysis.

This approach identifies organisations as norm-based and norm-governed systems - composed of the three subsystems, already referred: substantive, message passing and control. One of the important assumptions of this model and which is the attribute that makes this model so robust in organisational re-engineering settings, is that healthy organisations consume a very small proportion of resources in message-passing and control activities and direct and concentrate most resources to building up an organisational platform for substantive activities – those that are critical to the attainment of the organisational business objectives. An unhealthy organisation, with an heavy investment in the last two subsystems – message passing and control - may be characterised as a bureaucratic infrastructure that would benefit from a re-engineering process, where the effectiveness of the organisation would be enhanced.

This model analysis an organisation through the specification of norms and «affordances», using NORMA (Stamper, 1985), a language that enables an analyst to study the behaviour of agents in an organisation. According to these authors, the roles of agents in an organisation can never be over emphasised as they construct much of the business world through their social and business practices.

The greatest strength of this model of systems’ analysis is twofold: (i) it is able to reach the necessarily precise information, from which software engineers may design the mechanical, automated and computational part of the information system, (ii) and it also gives insights into the richness and complexity of the human side of information systems, in an organisational context.

Software engineering, and its supporting theory of computation, have nothing to say about meanings, or intentions behind the data being processed, nor about responsibilities, the social value of the information systems or justifications beyond their mechanical function. This broader approach, that is possible through this model, is a way of promoting, as architects of organisations, the tasks of systems’ analysts and designers. These tasks, must be focused on facilitating the evolution of the patterns of organisations that best suit the people involved, the business, the market and the organisation itself. These tasks, must not be a way to dictate the structures to be used – they must reflect the needs of people rather than the demands of machines.
Another important aspect of the semiotics morphology model of organisations is that it is quite general for all organisations in the same kind of business, so that it may be further developed to be applied in a larger scale to organisational re-engineering and information system development.

As was already referred, this model has the critical advantage of specifying the (human) information system so that software engineers can then build the computer-based systems. It contrasts with the usual mechanistic models of information systems and acknowledges the intrinsic ambiguity and complexity of organisations. The techniques used sharpen the attention, perceptions and sensitivity of the analysts to the kind of problems that cause systems to fail when technology is arrogantly imposed in an organisation.

2. An illustration of the model

K. Liu et al (1997), use an illustration of a re-engineering process given by Hammer (1990), where Ford Motor Company was aspiring to reduce the 500 staff in accounts payable to 400 by being more efficient with its internal computer system until it looked at Mazda. Mazda’s accounts payable consisted of a total of 5 people. The difference in absolute numbers was astounding, a dramatic illustration of the difference between efficiency and effectiveness. Ford was trying to increase efficiency in its data handling. Mazda ran the business in a totally different way which was more effective by operating through an invoice-less payment system (italics used in the original document).

Looking more closely into both systems, we verify that when Ford’s purchasing department wrote a purchasing order, a copy of it was then sent to the accounts payable. Later, when material control received the goods, it sent a copy of the receiving document to the accounts payable. It was up to the accounts payable, then, to match the purchase order against the receiving document and the invoice. If they matched, the department issued payment.

Mazda, on the other hand, remits payment to their suppliers as soon as the correct goods arrive at the department, originating the order where the exact requirements are precisely known.

Obviously, these two different processes resulted in dramatically different consequences. Ford had only automated a traditional paper-chase system without any re-engineering. Internally generated inconsistencies in these documents richly supplemented the core activities of the accounts payable. The problem of most computer-based information systems development methods is that they focus on passing of messages and the processing of the data elements contained in them. They are mainly directed at improving efficiency (Stamper, 1993).
Liu et al (1997), use this example extensively to illustrate an application of the organisational morphology model. At the substantive level, they identify exactly what communications are necessary for doing the business. This would give the basis on which to conjecture radical changes. The substantive messages, are the essential messages, as they relate to what the organisation actually does and to its objectives and goals. To improve effectiveness, it is necessary to strip down the system to perform all the essential tasks, including these communicating acts, but little else. The substantive acts represent the basic functions of the organisations which are generally stable for the whole business cycle.

The other messages, like messages about messages and control of messages, are closely related to the management style in a particular organisation. They are likely to change from time to time, when people, technology and other factors change.

Organisational engineering, as was already referred, should mainly target on these parts so that the energy and efforts of the organisation can be directed into the core substantive activities.

Especially when introducing information systems into organisations, many functions like looping and reconciling can generally all be done automatically by the computer.

Even if we do not use a computer at all, we can still do things differently in these parts of the system by asking why this and why not that. According to these authors’ commentaries, in Ford’s system, the functions of the material control department are quite questionable. «Do they have to have such a department to perform these functions? Do they know more about materials than the people who use them?» - are some of the questions posed.

The answer may be quite different from organisation to organisation and from time to time. The Mazda’s system does precisely that – concentrating in the substantive, core activities, area and cutting the ‘fat’ out of the message passing and control. By putting material control into the department that requests the goods, the communication about receipt is made as simple as possible. By holding details of the final contract on a shared database, the department and the accounts payable have all the necessary information to ensure the compliance and the addition of a ‘flag’ to say that the goods have been received by the department, allows the accounts payable to remit payment without need for the slow and error-prone reconciling copies of receipts, orders and invoices. The vendor has no need to send an invoice. The savings are significant.

If we imagine two levels, one of message passing and one of substantive acts, we may verify that the usual methods employed in restructuring processes concern mainly the activities related with message passing, like the data-flow of the Ford system. When working only on this level
of business procedures, we can only analyse and design in terms of message passing, the data elements and the processes on them. The normal procedure would then be to automate that system, perhaps with some minor adjustments. This way, we may certainly improve information systems efficiency. But messages and procedures are not the substantive business activities. To recognise problems of effectiveness and to work on them one must deal with the substantive area, where the critical and core activities are analysed.

3. Final comments to information systems modelling

The idea behind the citation «think global, act local», is present in the design of this study, namely, through the linking of different perspectives of analysis.

Another related concept (Dentinho, 2000) cites: «think at eternity, act at the margin». This citation confronts the dialectic tensions involved in planning with a long term framework, especially when environmental issues are concerned, to the need to set action criteria based in the powerful tool of economics marginal analysis. It is at the margin that the optimal solutions are identified.

A further development, and over simplification, of these citations is just: «think and act». This may be a hidden objective, yet more profound, of this study. We cited the information era and the knowledge society, but we all live, recognise and suffer from non-knowledge situations, where organisations, as a whole, and individuals, per se, refuse, first to think – which implies to confront, to question, to reflect, to evaluate and to decide – and then, to act – to act according to the reasoning and decision made, and not solely following a pre-defined pattern. As is referred by a popular saying: «There is no one more blind than someone who doesn’t want to see.»

The accelerating evolution of information technology was not followed by a similar evolution in terms of human knowledge and behaviour. These are conditioned by complex factors, related to cultural factors like the prevalent mentality, and to civilisational issues that have been present for centuries, if not millennia. When referring the «knowledge society» does not mean that knowledge is certain, or even easily accessible, but rather that there has been a change in paradigm, where knowledge, and knowledge management, are the critical attributes and competencies.

As a fundamental concept for the new millennium, information systems must not be focused solely on the mechanical and technical parts of the system but must integrate an alternative perspective that acknowledges the intrinsic ambiguity and complexity of organisations, where power and politics make nonsense of any claim of objectiveness. Organisations are the real
information systems, and the technical bias that is often present in information systems design failures is not related to technically inadequacy but to the fact that the system does not adequately serve the organisation.

4. References


