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The Role of Business Processes and Enterprise Architectures in the Development of Organizational Self-Awareness

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Abstract. This paper is about a partnership between two disciplines: organizational studies and information systems engineering. It is argued that organizational studies has much to benefit from the conceptual development that has been taking place in the representation of organizational processes and enterprise architectures (EA) and that systems engineering can greatly expand its execution capability by absorbing a variety of messages coming from social or organizational theory. The concept of Organizational Self-Awareness (OSA) is offered as the contextual framework for the discussion. OSA is a process which involves, firstly, the efforts of the individual organizational member in getting to know his/her work environment, through sensemaking. Sensemaking is influenced by a number of factors, some related to the individual's psychological makeup, others related to the individual's work environment. EAs can play a relevant role in sensemaking. From activity theory the paper highlights the process of consciousness formation in human beings as well as the mediating artefacts that shape and constrain the acquisition, accumulation and development of knowledge and self-knowledge. Among the many mediating artefacts in the work environment EAs are a special type. EAs are also boundary objects due to their distinctive ability to influence perspective making and perspective taking in the process of organizational sensemaking. The paper concludes that the design and use of EAs can play a crucial role in the formation of a collective mind about the state of the organizational processes and therefore about the state of the organization.

Keywords: Organizational Design and Engineering (ODE); Enterprise Architectures (EA); Business Processes, Organizational Self-Awareness (OSA), Sensemaking, Structuration, Organizational Constructionism, Autopoiesis, Organizational Intelligence, Organizational Complexity.

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Resumo. Este artigo foca a parceria entre duas áreas disciplinares: a dos estudos organizacionais e a da engenharia dos sistemas de informação. Argumenta-se que os estudos organizacionais têm muito a ganhar com os desenvolvimentos conceptuais decorrentes da representação dos processos organizacionais e das arquitecturas empresariais (AE) e que a engenharia dos sistemas pode aumentar significativamente a sua capacidade de execução se absorver a variedade de mensagens emanadas pelas teorias sociais e organizacionais. O conceito de Consciência Organizacional - (CO) - é proposto como o enquadramento contextual adequado para a discussão. A CO resulta de um processo que envolve, em primeiro lugar, os esforços de cada membro individual de uma organização em conhecer a sua envolvente, usando os seus sentidos e o seu "sensemaking". Esta capacidade pessoal de apreender e compreender o meio ambiente é influenciada por vários factores, uns relacionados com o perfil psicológico de cada indivíduo, outros relacionados com o ambiente de trabalho individual. As AEs podem desempenhar um papel muito relevante no suporte à capacidade individual de "sensemakig". Partindo da "Activity Theory" este artigo enfatiza o processo de formação de consciência nos seres humanos, bem como o papel dos artefactos que medeiam, conformam e restringem a aquisição, acumulação e desenvolvimento do conhecimento e do autoconhecimento. Entre os múltiplos artefactos que medeiam o ambiente de trabalho, as AEs constituem uma classe à parte. As AEs são objectos fronteiriços (boundary objects) dada a sua capacidade diferenciadora de influenciar a formação de perspectivas do meio ambiente por parte dos indivíduos, e consequentemente de condicionar as perspectivas que estão na base dos processos de formação da consciência colectiva sobre uma dada organização, que designamos por "organizational sensemaking". O artigo conclui que o desenho e o uso das AEs podem desempenhar um papel relevante na formação da consciência colectiva sobre o estado dos processos organizacionais e em última análise, sobre o estado presente da própria organização, como um todo.

Palavras-chave: Organizational Design and Engineering (ODE); Enterprise Architectures (EA); Business Processes, Organizational Self-Awareness (OSA), Sensemaking, Structuration, Organizational Constructionism, Autopoiesis, Organizational Intelligence, Organizational Complexity.

1. Introduction

The entry of Information Systems (IS) into every walk of life is having a merging effect between the hard and the soft sciences. The new bridge between the two camps comes from the new capability that humans have to represent large chunks of reality in terms of information. Science, including social science, is increasingly about the collection, organization and transformation of information. It is argued that in the 21st century applied computer science is playing the role which mathematics played between the 17th and the 20th centuries, that is, providing an "orderly, formal framework and exploratory apparatus for other sciences" (Foster, 2006: 419).

The pervasive effects of computer science are being felt also in the organization science. Computer-based information systems are having a large impact on the form and effectiveness of organizational design through a host of new capabilities in the coordination and control of organizational processes (Weick, 2001; Malone et al, 2003), competence management (Hoogervorst et al, 2002; Lindgren et al, 2004) strategic alignment (Chan, 2002) or boundary spanning mechanisms (Pawlowski and Robey, 2004; Levina and Vaast, 2005). This body of literature appears against a broader background of intellectual endeavour which brings together a variety of hard and soft characteristics of organization, under the banner of knowledge creation and dynamic capabilities (Kogut and Zander, 1992; Teece et al, 1997; Kogut, 2000; Eisenhardt and Martin, 2000), non-linearity and organizational evolution (Brown and Eisenhard, 1997; Lewin and Volberda, 1999; Lewin et al, 1999); emergence and complexity (McKelvey, 1997, 1999).

This wave of research with a strong emphasis on the need to integrate knowledge from different fields and paradigms has caused a number of new issues to surface. One key issue concerns a topic which has consistently been neglected by the organization sciences over the years – organizational (or business) processes. Processes are the essence of organizations (or their "organization" in the terminology of autopoietic systems) but due to their immateriality and difficulty of representation, processes have been deemed to be a concern of engineering alone. Associated with business processes, a whole new area of organizational representation have emerged which has also eluded the majority of organizational researchers – the area of enterprise architectures (EA). EA were primarily conceived as tools for designing and implementing information systems fully aligned with the design of the organizations, by making explicit the blueprints of the organizational aspects that are concerned with the information system design. In this way, they can be used as important artefacts to improve the effectiveness of organizational designs and eventually for the redesign of existing organizational forms.

Enterprise architectures (EA) aim to be the representation of the organization's holistic self. They can be viewed along different dimensions, projected in distinct semantic planes, enabling, from such an holistic model, the generation of restricted, specialized views and models, which are adequate to support the different dimensions, functions, departments, specialties that exist in the organization. However, the reverse is not true, i.e. if one is given different enterprise models, each having been built in accordance with different dimensions, functions, departments and specialties, their sum total will not produce a coherent and unified picture of the organization as a whole.

Building on the engineering skills to represent the organization through processes and architectures and on the accumulated knowledge of organization science to understand the social nature of organizational contexts, a host of new research questions can be formulated. For example:

- How might EA be used to influence the level or the quality of sensemaking in the organization (Weick and Roberts, 1993; Weick, 1995; Bohm, 2004)? Given the way that EA makes work and information flows visible, how might such explicitation affect individual and collective understanding of the organization's state of affairs?
- How does real-time information and communication affect information design? Time has an impact on organizational design (Brown and Eisenhardt, 1997; Orlikowski and Yates, 2002; Lindgren et al, 2004; Crossan et al, 2005). Can EA be used to research the impact of real-time?
- What might be the impact of using EA as a tool for changing our perspective of information systems users, from an individualist user concept to a social actor context. Lamb and Kling (2003) argue that the "socially thin" user construct that most of IS research utilizes, limits our understanding of information, manipulation, communication and exchange within complex social contexts.

In this paper we approach the first question, i.e. given the capability of EAs to make work and information flows visible, how might such explicitation affect individual and collective understanding of the organization's state of affairs? We propose that EAs can be used as an intervention method for improving the effectiveness of organizational designs and eventually for the redesign of existing organizational forms. Much like in the most conventional and mature engineering fields, the role of enterprise modelling as an activity is to improve the active synchronization of the organization's human and non-human agents, thus becoming the source of the explicate order which creates the implicate order that we call "organization". Off line, enterprise models are extremely useful to support reasoning, innovation, conception, design and engineering of the organization,

while on line they could become instrumental in monitoring, controlling and auditing the organization's activities.

2. The Need For Organizational Representation

Graphical representation has proven to be a complex instrument of communication in complex environments. On one hand, as far as we know, no complex thing (object/product) has ever existed without first being drawn. On the other hand, large teams of professional work together in very complex things communicating mostly via schemas or blueprints.

A schema (or a blueprint) of an existing thing is a repository of information to be passed along multiple readers that, unlike words, encompasses some basic principles (Boar, 1998):

- One must choose a minimum set of fundamental concepts, upon which the information (or communication) can be assembled. These are the Architectural elements (or concepts) upon which information is defined.
- No concept corresponds to the same symbol, and no symbol corresponds to different concepts. This is a coherent schema/blueprint. No misunderstanding will result from multiple interpretations of the message.

Such properties could also be achieved with words, and indeed many word based communication rules do. However, among humans, graphical and structured perception seams to easily capture of the complexity of the descriptions. We probably cannot prove this last statement, but suffice is to say that no engineer has made significant progress before a comprehensive set of representative concepts and their graphical representation has been established.

In terms of its many material and information flows, it seems to us that organizations are no simpler than some of the objects that engineering produces today and full comprehension requires similar tools and methods. Hierarchical organizational charts are one of the most used graphical representations of organizations, based on a single key concept of unit or department. But organizations are far more complex than such a simple view. This is reason why the discipline of Enterprise Architecture starts by identifying the key concepts of organizational blueprints and their representation (Sowa and Zackman, 1992; Pereira and Sousa, 2004; Pereira and Sousa, 2005).

3. The Descriptive Properties Of Business Processes

Business Processes have been a keystone in several domain areas, from a foundational platform to justify and sustain organizational change to IT alignment or enterprise performance indicators (Senge, 1990; Davenport and Short, 1990; Hammer, 1990; Davenport, 1993; Davenport, 1994; Davenport and Beers, 1995; Porter, 1985; Grover et al, 1995; Labovitz and Rosansky, 1997; Hammer and Champy, 2001).

However, it seems that concept of "process" is not sound enough to be a basis upon which one could build complex thoughts or systems. The evidence for this perception is sustained in multiple facts: constant production of business process blueprints; existence of disparate business process blueprints in different areas[2]; and different process drawing teams always arriving at different process blueprints.

Common definitions of business process concepts are:

- A process is a course of action, a series of operations, or a series of changes [3].
- Processes represent the flow of work and information throughout the business (OMG, 2005).
- A business process is a collection of activities that takes one or more kinds of inputs and creates an output that is of value to the customer (Hammer and Champy, 2001).
- Every organization exists to accomplish value-adding work. The work is accomplished through a network of processes. Every process has inputs, and the outputs are the results of the process (ISO, 1995).
- A kind of process that supports and/or is relevant to business organizational structure and policy for the purpose of achieving business objectives. This includes manual and/or workflow processes (W3C, 2002)
- Business process is the manner in which work is organized, coordinated, and focused to produce a valuable product or service (Laudon and Laudon, 2000)
- A process is a circle of causality that describes a feedback loop of cause and effect. From the systems perspective, the human actor is part of the feedback process, not standing apart of it (Senge, 1990)

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[2] One can find different views of a process depending upon where one looks, i.e. Process Owner, IT, Quality, Auditing or Human Resources

[3] Concise Oxford English Dictionary (2006)

- A business process is the complete and dynamically coordinated set of collaborative and transactional activities the deliver value to customer (Smith and Fingar, 2003).

All these definitions are easy to agree with but are not able to offer a single, common process blueprint. In fact, for any given enterprise, there are as many processes blueprints as one could want that match those definitions. This is true, regardless of process analyses or blueprints methodologies following top down approaches that breakup value creation in to smaller activates, or bottom up approaches, that aggregate activities into value creation wholes.

In our engineering approach to process analyses and blueprint, we adopt one of Zackman's (1987) fundamental lessons: every existing thing is characterized by the answers to a well know set of six questions: *when, what, where, who, how, and why*. In our view, a process is a set of elements (activities or sub-processes) where:

- No two elements have the same *when, what, where, who, how,* and *why*.
- No two values exist for each *when, what, where, who, how,* and *why* within an element.

This means that, during the process analyses and modelling, if activities *A* and *B* have no different *when, what, where, who, how,* and *why*, then they should be regarded as a single activity. On the other hand, if an activity holds multiple answers for *when, what, where, who, how,* and *why*, then it should be sub divided into different activities (Sousa et al, 2006b).

For example, if the activity "finish door" involves a carpenter and a painter (different *who*), than it should be modelled as two activities. Likewise, if one activity is done in different cities (different *where*), then it should modelled apart.

Applying these rules leads to a large number of process elements. Such long elements chain is not very practical for human manipulation and analysis. However, it holds the necessary information to achieve two major results:

- Independence from the teams doing the process analysis.
- Powerful enough for building specific views to specific process stakeholders. One only needs to select the desired, distinct values of *when, what, where, who, how,* and *why*.

A view based on different *why* would lead to the common value producing view of processes. A view based on different *where, what* and *when*, would by suited for a logistics view of the processes. A view based on different *who*, would be adequate

for the human resources analysis. A view based on different *what* and *how*, would be suited for and information systems analysis, and so on.

We believe that such an engineering approach for processes would lead to a solid basis for addressing other domains, such as Enterprise Architecture.

4. The Communicational Nature of Enterprise Architectures

Enterprise Architectures (EAs) provide integrated conceptual frameworks that enable the description of the organization from several perspectives or viewpoints. Whereas organizational models for management purposes are mainly textual descriptions, characterized by a high level of abstraction that can only be used and interpreted by humans, the EA models have achieved a greater level of detail using more formal languages, enabling the development of several EA tools based on these models. They are also extended approaches to IS implementation, although representing an evolution in relation to traditional systems design and implementation in that the systems development is founded on the business process goals and models. They are also an evolution in relation to strategic IS planning, as some of these architectures are intended to develop integrated frameworks that encompass system planning and system implementation as well as process, production and retirement activities. This integration has been accomplished by combining the Enterprise Architecture methodological framework with a software development framework, namely the Rational Unified Process - RUP (Kruchten, 2003) in the cases of Enterprise Unified Process - EUP (Ambler et al, 2005) and Integrated Architecture Framework - IAF (Goedvok et al, 1999).

Organizational modelling in the Information Systems (IS) field emerged approximately 20 years ago (Sousa et al, 2006a) from the widely acknowledged need of designing and implementing IS to support the business. After nearly a decade of neglect, large organizations are suddenly becoming interested once again in modelling organizations at the highest level. EA are also tools made of language (textual and diagrammatic) which mediates between organizational members and their organization. Therefore, EA are also important communication tools which can be instrumental in forming the awareness of organizational members about their organization. They have been used for promoting data sharing, thus reducing data redundancy and reducing maintenance costs; for component development, management and reuse; to reduce software development cycle time; to enable strategic information to be derived from operational data; to facilitate change management (North et al, 2004).

Building on the capability of EA to define the organization's systems development environment through guidelines and standards, but building especially on its communication power, new questions can be formulated, such as:

> *Given the way that EA makes work and information flows visible, how does such explicitation affect individual and collective understanding of the organization's state of affairs? How might EA be used to influence the level or the quality of sensemaking in the organization*? *If EAs are rightfully considered as boundary spanning objects, how does their design and use affect the stability of organizational processes? How can EAs be used as catalysts of change in organizational design?*

In the sections below we hope to begin finding answers to these questions and we will do so from the point of view of the organizational sciences. Our intention is to establish a foundation from which our investigation into various aspects of organizational design and engineering (ODE) can profit from. ODE is a multidisciplinary research project born at the Department of Information Systems and Computer Engineering of the Instituto Superior Técnico in Lisbon, Portugal and now established at the Centre for Organizational Engineering of INESC. ODE takes a realist and emergent stance on organization, reaffirming it as a socio-technical phenomenon which self-realizes in the actions and interactions of its component parts. Borrowing from Kallinikos (2004), the aim of ODE is to map out how IS participate in the making of local contexts and situated forms of learning by defining the domains of relevance and providing the means for acting and reacting upon such domains, through communication, information exchange and work monitoring.

5. A Dynamic View of Enterprise Architecture as Part of Organizational Social Action

Our perspective on EA is based on a view of organization as a socio-technical entity which self-realizes in the permanent action and interaction of its component parts. This view of organization is the outcome of a number of intellectual influences, namely organizational constructionism (Giddens, 1984), autopoiesis (Maturana and Varela, 1980; 1987), organizational intelligence (March, 1999), organizational complexity (Tsoukas, 2005), to mention only the most important. In this paper we focus on the organization as the resultant of the actions of individual persons or social actors. We concur with the view that the "socially thin" user construct that most of IS research utilizes, limits our understanding of information, manipulation, communication and exchange within complex social contexts (Lamb and Kling, 2003)

Weber (1978) was largely responsible for the early development of the action perspective, the key tenet being that society is comprised only of individuals. The task of sociology is, therefore, to explain social structure in terms of the understanding that individuals have of society and of their actions in it. Action is social "insofar as subjective meaning takes into account the behaviour of others" (Ibid, p.4). Human agents or actors have the capacity to understand what they do and these reflexive capacities are (a) largely carried tacitly and (b) involved continuously with the flow of day-to-day conduct in the contexts of social activity. It is the specifically reflexive form of the knowledgability of human agents that is mostly deeply involved in the recursive ordering of social practices. Continuity of practices presumes reflexivity, but reflectivity in turn is possible only because of the continuity of practices (Giddens, 1984).

Structure is another important notion originating from social theory. Structures are sets of rules and resources recursively organized as properties of social systems. Rules are procedures of action, aspects of praxis. Rules are generalizable procedures applied in the enactment or reproduction of social practices. Resources are structured properties of social systems, drawn upon and reproduced by knowledgeable agents in the course of interaction. Resources are the media through which power is exercised. Structure is saved as memory traces and is recursively implicated in social systems. Social systems comprise the situated activities of human agents, reproduced across time and space.

The notions of agency and structure are the cornerstones of structuration theory, Giddens's (1984) landmark proposal as the "third way" in sociological thought. It aims to reconceptualize the dualism between human agency and social structure and suggest a recurrent duality between agency and structure. For Giddens, social action makes up what he calls the system, that is, the observable patterns of events and behaviour; the other part of the duality – the structure – comprises the unobservable rules and resources used to generate the system. Structuration is thus the process of producing and reproducing social structures (i.e. reality) through the daily activity of social actors. When interacting, people draw on unobservable resources which can be of three types - signification, domination and legitimation. Signification resources are used in order to allow the formation of meaning during an interaction. Domination resources are deployed in order to bring power into the interaction and to influence its outcome. Legitimation resources are brought into play in order to bring in authority, to command and to sanction. All three elements of structure are present in communication in a totally intertwined manner.

One form of communication is a conversation which can place between two or more persons. When conversations happen and become recurrent among the same group of people, a social network, a group or a micro-community is formed. Conversations allow the structuration process to evolve and once the structure of the network is formed, conversations become organizationally closed and self-

referential. Metaphorically speaking, conversations have embedded in them the genetic code of the social network, through the three elements of structure - signification, domination and legitimation. All groups with their internal dynamics, their roles and their values develop through conversations. Hence, for a newcomer to become part of a group - a behavioural domain – he or she has to learn, through participation, the group's genetic code and his or her role in it. And in this way, the social individual becomes structurally coupled to the social network.

> Each social system is constituted as a network of co-ordinates of actions or behaviours that its components realize through their interactions in mutual acceptance (Maturana, 1988:67) As a particular social system is realized and conserved through the participation of its members in the network of conversations that constitute it, [such network] specifies the characteristics and properties that its members must have (ibid, p.69)

Hence, a social actor is "an organizational entity whose interactions are simultaneously enabled and constrained by the socio-technical affiliations and environments of the firm, its members and its industry" (Lamb and Kling, 2003: 218). Part of the socio-technical environment of the firm is made of the representations of organizational characteristics available through the increasing use of IT artefacts (for example, organizational and individual performance indicators). Social actors use computers, information products and other information systems in their interorganizational and interpersonal relations. Among these we find also Enterprise Architectures (EAs). All these artefacts not only shape who the social actors are, as organizational members, but also what they can do in terms of their interactions with other organizational members.

6. Sensemaking and Organizational Design as the Bases of Organizational Self-Awareness

Structuration theory can be refined further in search of the intellectual foundations for a new construct that we have labelled *organizational self-awareness* (Tribolet, 2005). Such a refinement can be found in the teachings of Weick (1995) about the social construction of organization and especially about the concept of sensemaking, a key cognitive mechanism for the social construction of reality. Sensemaking is about "the enlargement of small cues". It is about the "search for contexts within which small details fit together and make sense". It concerns "a continuous alternation between particulars and explanations, with each cycle giving added form and substance to the other". Finally, it is about "building confidence as the particulars begin to cohere and as the explanations allow increasingly accurate deductions" (1995:133). In the following definition of organization Weick

highlights two layers of sensemaking which correspond to two layers of organizational activity: the intersubjective and the generic subjective.

> [Organizations are] social structures that combine to the generic subjectivity of interlocking routines, the intersubjectivity of mutually reinforcing interpretations, and the movement back and forth between these two forms by means of continuous communications. (1995:170)

The first level - intersubjective meaning - happens when at least two persons communicate their thoughts, feelings or intentions, moving the interaction from the "I" state to the "we" state. The intersubjective level is the level where "social reality" begins to emerge. The next level is the generic subjectivity level, which corresponds to social systems where interacting human beings are no longer present as they have been replaced by roles or identities. "Social structure implies a generic self, an interchangeable part - as filler of roles and follower of rules - but not concrete individualized selves" (Wiley, quoted in Weick, 1995:71).

Frequent interpersonal communication about work reinforces shared meanings (by "mutually reinforcing interpretations"), making participants more mutually dependent and their activities more mutually predictable, thus increasing both intersubjectivity and generic subjectivity. According to Weick, organizations are adaptive social forms "animated by movement and communication". As intersubjective forms they create, preserve and implement the innovations that continually arise from personal interactions. As forms of generic subjectivity, they exert control over the energies generated by such innovations. Hence, there is a tension between the two forms of subjectivity inherent in the attempt to reconcile the innovation afforded by intersubjectivity with the control exerted by generic subjectivity.

Sensemaking, defined as structuring unknown contexts and/or actions and assigning them with meaning, is distinguished from other explanatory processes such as understanding, interpreting or attribution, by seven characteristics (Weick, 1995). These describe sensemaking as a process that is: (1) grounded on identity construction, (2) retrospective, (3) enactive, (4) social, (5) ongoing, (6) focused on and by extracted cues and (7) driven by plausibility rather than accuracy. The seven properties of sensemaking affect the initial sense that a person develops of a situation and strongly influences the way that the person will update and develop their perception of the situation, for future action. In other words, sensemaking lies at the foundation of a consciousness or awareness that organizational actors develop of the organization as a whole and of their place in it.

According to Weick (2001) the seven properties of sensemaking are also affected by organizational designs. Some organizational conditions seem to hinder sensemaking while others seem to enhance it. This is where the use of EA as an implementation tool comes in. If we are able to represent organizational conditions through EA and link sensemaking outcomes to the architectural representation of

the organization, we would succeed in improving sensemaking on the drawing board, so to speak. This would not only be a factor of information systems development and implementation, but would involve design issues involving the organization as a whole.

A word of clarification about organizational design is needed given the temptation often associated with the architecture metaphor, to consider design as a static process occupying a well defined point in time. We concur with Weick (2001) when that author says that the expression organizational design contains a trap. The semantic trap has to do with the fact that the word *design* can be used either as a noun or as a verb. Often, *design* is taken to mean things like organizational charts, written procedures or job descriptions and the more dynamic connotation of design are often neglected. In arguing that "a well designed organization is not a stable solution to achieve but a developmental process to keep alive" (Ibid, p. 60), Weick makes a case for an alternative set of assumptions for organizational design

Traditional assumptions	**Alternative assumptions**
A design is a blueprint	A design is a recipe
A design is constructed at a single point in time	Designing is continuously reconstructed
Designs produce order through intention	Designs produce order through attention
Design creates planned change	Design codifies unplanned change after the fact

7. Enterprise Arquitecture as a Mediating Artifact Shaping Organizational Self-Awareness

Activity theory incorporates strong notions of intentionality, history, mediation, collaboration and development in constructing consciousness (Nardi, 1996). Although not originally conceived as a social theory, it is consistent with many of the notions of Gidden's (1984) theory of structuration and Maturana's (1988) notion of the formation of social networks. Activity theorists argue that consciousness is not a set of discrete disembodied cognitive acts (decision making, classification, remembering), and certainly it is not the brain. Rather, consciousness is located in everyday practice, i.e. you are what you do. And what you do is firmly and inextricably embedded in the social network of which every person is an organic part. This network is composed of people and artifacts. Artifacts may be physical tools or sign systems such as an EA.

A key principle of activity theory is tool *mediation*. Tools shape the way human beings interact with reality. Tools also reflect the experience of other people who

encountered and solved similar problems and invented or modified a tool to make it effective and efficient. The use of tools constitutes an accumulation and transmission of social knowledge, influencing the nature not only of external behaviour but also of internal mental functioning Vygotsky (1978).Technical tools manipulate physical objects (e.g., a hammer) while psychological tools are used to influence other people or oneself (e.g. a calendar or an advertisement).

In activity theory the unit of analysis is an activity. Leont'ev (1974) has described an activity as being composed of subject, object, actions, and operations. *Actions* are goal-directed processes that must be undertaken to fulfil the object. They are conscious (because one holds a goal in mind), and different actions may be undertaken to meet the same goal. Moving down the hierarchy of actions we cross the border between conscious and automatic processes. *Operations* are actions which become routinized and unconscious with practice. Operations do not have their own goals; rather they provide an adjustment of actions to current situations. When learning to drive a car, the shifting of the gears is an action with an explicit goal which must be consciously attended to. Later, shifting gears becomes operational, and "can no longer be picked out as a special goal-directed process: its goal is not picked out and discerned by the driver" (Nardi, 1998). The *actors involved* comprise multiple individuals and/or sub-groups who share the same general object of activity and who construct themselves as distinct from other groups. *Social rules* refer to the explicit and implicit regulations, norms and conventions that constrain actions and interactions within the activity system. Lastly, *division of labour* refers to both the horizontal division of tasks between the actors involved and to the vertical division of power and status.

Figure 1 depicts the elements of activity. From this diagram it can be appreciated how an activity is a whole made up of elements which are not fixed, but can dynamically change as conditions change. In order to understand how such whole works, there must be a grasp of the remaining key principles of *development* and *object-orientedness*. The first principle assumes that events are not analysed in isolation but should always be seen as a result of *development* over time. It regards behaviour as a holistic phenomenon that cannot be frozen in a series of cross-sectional snapshots but has to be researched longitudinally as a continuous process. The second principle of *object-orientedness* means that every motive is an object, but there is another related sense of the word object, i.e., a prospective outcome toward which activity is directed and around which activity is coordinated. For example, bread is an object of a baker's activity. Bread is not her "motive" but is that toward which the baker directs her activity so she can attain a motive, i.e. making good bread. Thus, objects may include both physical and social entities.

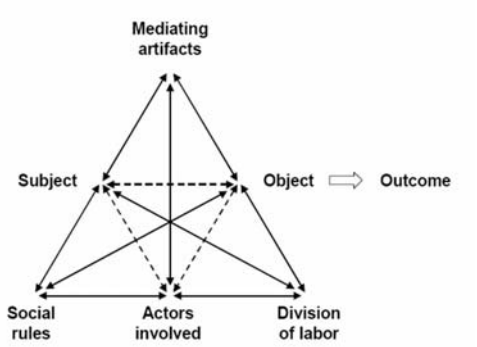

Figure 1. The Elements of Activity (Engeström et al., 2005)

For activity theory then, what it means to have a human consciousness is to be a part of a web of social activities and to live and act in a culturally elaborated environment that is profoundly artificial, populated by a wealth of tools, including language (Nardi, 1996). Vygotsky's (1978) definition of consciousness emphasizes the active processes of the higher and lowers psychological functions. Lowers functions are basic capabilities such as attention, will or intention. The higher functions include language, decision making, abstraction, generalization, classification or problem solving. Because these functions arise, develop and change within a social network, they cannot be seen as residing strictly "under the skull', i.e. consciousness is a social phenomenon, simultaneously beyond and within the individual. This is in line with Giddens' theory of structuration which assumes that human action is restricted by institutional properties of social systems while, on the other hand, these institutional properties are the product of human action.

8. Enterprise Arquitectures as Boundary Spanning Artifacts

According to the knowledge-based view of strategy, the ability of the firm to integrate and combine various sources of expertise is a crucial source of competitive advantage. Such integration, however, encounters a variety of obstacles associated with the embeddedness and tacitness of knowledge (Levina and Vaast, 2005). Boundary spanning objects have been suggested as loci of accumulation of knowledge sitting at the junction between various group-specific memories as well as coordinating such memories in organizations (Cacciatori, 2006). They refer to a wide range of artifacts that "are plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a

common identity across sites" (Star, 1989: 393). Boundary spanning objects range from prototypes to architectural drawings or to computer-based information systems.

Effective boundary objects are those which are not only tangible, accessible and up-to-date, but also accepted and used (Bechky, 2003; Carlile, 2004). Levina and Vaast (2005) make a useful distinction between nominated or designated agents or objects and boundary spanning-in-practice. Those authors refer to boundary objects-in-use as those artefacts that with or without designation, are incorporated into the practice of diverse groups in the organization, acquiring a common identity in joint practices. They mediate the changing relationships between the groups or communities involved by affecting perspective making and perspective taking capabilities (see Figure 2). "Making a strong perspective and having the capacity to take another perspective into account are the means by which more complexified knowledge and improved possibilities for product or process innovation are achieved" (Boland and Tenkasi, 1995: 369).

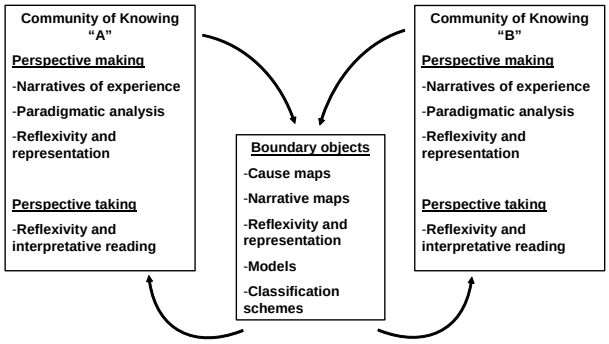

Figure 2. Perspective Making and Perspective Taking (Boland and Tenkasi, 1995)

Cacciatori (2006) argues that our concept of boundary objects has emphasised too much their collaborative dimension at the expense of their role in organizational conflict. This is due to the fact that such artefacts provide a point of entry for the control of knowledge accumulation on the part of the contributing groups. Their evolution is influenced by the need to solve concrete problems on one hand but on the other hand it is also the result of the balance of power among the communities. If both dimensions are taken into consideration, boundary artifacts can be usefully explored as memory objects structuring the process through which access and control over knowledge is regulated. Through an understanding of the dynamic co-evolution of the boundary artefact and the organizational processes it supports, knowledge integration (and hence OSA) can be better understood. Also, this will

give us important insights regarding the design of boundary spanning artefacts.

Our thesis is that the formation of OSA can be significantly influenced by the presence of an architectural plan of the organization. On this point Weick (1995:75) provides the following powerful insight:

> A basic focus of organizing is the question, "how does action become coordinated in the world of multiple realities?" One answer to this question lies in a social form that generates vivid, unique, intersubjective understandings that can be picked up and enlarged by people who did not participate in the original construction. There is always some loss of understanding when the intersubjective is translated into the generic. The function of organizational forms is to manage this loss by keeping it small and allowing it to be renegotiated.

If one considers EA not only as a representation of the organization but also as a boundary object spanning the structure, the processes, the procedures and the monitoring of work (i.e. a guide to organizational form), it can have a very significant impact on the formation of the awareness of organizational members, at all levels. It will be able to generate not only "vivid, and unique intersubjective understandings" but it will also reinforce such an awareness when it is translated to the generic, that is the broader organizational level.

9. Conclusion

We talk of *organizational self-awareness* (OSA) as a new construct which can play an important integrating role in the research linking organizational behaviour and computer science. The propositions put forward in this paper highlight three kinds of implications. The first implication addresses the need for solid methods for representing the organization's physical activities. Such methods must start from a consensual position regarding what defines the organization in terms of its physical activities and in our view such foundational definition can be found in the concept of organizational process. Building upon an agreed method for eliciting organizational processes, the next step in the effort to represent the organization is achieved through the design of blueprints known as Enterprise Architectures.

Traditionally, the organization sciences have neglected the description of the physical flows of organizational activity. This is due in part to the difficulty of doing so with universally recognised methodologies and this,in turn, is related to the difficulty in finding a universally recognised definition of organizational process. We have put forward a definition of "process" as being a set of elements (activities or sub-processes) which meet two requirements: (1) no two elements have the same *when, what, where, who, how,* and *why*; (2) no two values exist for

each when, what, where, who, how, and why within an element. Based on these six qualifiers of description, it would be possible to obtain a full descriptive picture of the organization. A view based on different whys would lead to the description of the organization's strategic processes. A view based on different where, what and when, would fully describe the organization's operational processes. A view based on what and how, would describe the organization's information-based processes and a view based on who, would describe the processes requiring human intervention. Enterprise Architectures (EAs) on the other hand, provide integrated conceptual frameworks that enable the description of the organization also from several perspectives or viewpoints.

The second implication addresses the need for a common understanding of the phenomenon of organization and of organizational awareness. In this paper we have put forward a view of organizational phenomenon as the outcome of a number of intellectual influences, namely organizational constructionism, autopoiesis, organizational intelligence and organizational complexity. Supported by these epistemological and ontological underpinnings, we have argued that the organization is the resultant of the actions of its human and non-human actors organized as a socio-technical system which self-realizes in the permanent action and interaction of its component parts. Based on this view of organization, we have put forward that organizational self-awareness emerges as a simultanously invidual and group based phenomenon, firmly anchored on action taking place around mediating artefacts which serve as boundary spanning objects. If EAs can be made to span the structure, the processes, the procedures and the monitoring of work they can have a very significant impact on the formation of the awareness of organizational members, through the generation of "vivid, and unique intersubjective understandings", in the words of Weick.

The third implication touches upon the key proposition we put forward in this paper, i.e. the benefits and advantages of bringing together concepts from the hard and the soft sciences into the same research programme to form new and powerful conceptual tool. Organizational Self Awareness (OSA) is a case in point. Organizational self-awareness is a complex process which involves, first of all, the efforts of the individual organizational member in getting to know his/her work environment. This is done through individual sensemaking where EA can play a key role. Sensemaking is influenced by a number of factors, some related to the individual's psychological makeup, others related to the individual's work environment. If EAs are designed which map out the work environment in ways that provide new informational cues to the organization's members, sensemaking will be significantlt affected.

On the other hand, activity theory tells us that the environment is crucial in the process of consciousness formation in human beings, with activity itself being the primary factor in such a process. Consciousness formation depends also on

secondary factors that shape and constrain activity. From these factors we have highlighted the mediating artefacts, that is, the artificial elements that shape and constrain the acquisition, accumulation and development of knowledge and self-knowledge. Among the many mediating artefacts in the work environment, EAs are a special type. EAs are also boundary objects due to their distinctive capability to influence perspective making and perspective taking in the process of organizational sensemaking. Thus, it may be concluded that the design and use of EAs can play an important role in the formation of a collective mind about the state of the organizational processes and therefore about the state of the organization's "being".

References

Ambler, S. W., Nalbone, J. and Vizdos, M. (2005). *Enterprise Unified Process: Extending the Rational Unified Process*. Prentice Hall, Englewood Cliffs, NJ

Bechky, S. R. (2003). "Object Lessons: workplace artefacts as representations of occupational jurisdiction". *American Journal of Sociology*, 109 (3): 720-752

Boar. B. H; (1998) *Constructing Blueprints for Enterprise IT Architectures*. John Willey & Sons.

Bohm, D. (2004). *On Dialogue*. Routledge, London

Boland, R. J.; Tenkasi, R. V. (1995). "Perspective Making and Perspective Taking in Communities of Knowing". *Organization Science*, 6 (4): 350-372

Brown, S. L.; Eisenhardt, K. M. (1997). "The Art of Continuous Change: linking complexity theory and time-paced evolution in relentlessly shifting organizations". *Administrative Science Quarterly*, 42 (1): 1-34

Cacciatori, E. (2006). *Crafting Competencies for Strategic Renewal: the role of boundary objects*. Bocconi Working Paper. Bocconi School of Management, Bocconi University, Milano, Italy

Carlile, P. R. (2004). "Transferring, Translating and Transforming: an integrative framework for managing knowledge across boundaries". *Organization Science*, 15 (5): 555-568

Chan, Y. E. (2002). "Why Haven´t We Mastered Alignment? The Importance of Informal Organizational Structure". *MIS Quarterly Executive*, 1 (2): 97-112

Concise Oxford English Diccionary (2006). Oxford University Press, Oxford, UK

Crossan, M.; Cunha, M. P.; Vera, D.; Cunha, J. (2005). "Time and Organizational Improvisation". *Academy of Management Review*, 30 (1): 129-145

Davenport, T.H. (1994). "Reengineering: Business Change of Mythic Proportions?" *MIS Quarterly*, July: 121-127.

Davenport, T.H. (1993). *Process Innovation*, Harvard Business School Press, Boston, MA.

Davenport, T.H.; Beers, M.C. (1995). "Managing Information About Processes," *Journal of Management Information Systems*, 12(1): 57-80.

Davenport, T.H. & Short, J.E. (1990). "The New Industrial Engineering: Information Technology and Business Process Redesign," *Sloan Management Review*, Summer: 11-27.

Eisenhardt, K. M.; Martin, J. A. (2000). "Dynamic Capabilities: what are they?" *Strategic Management Journal*, 21: 1105-1121

Engeström, Y.; Miettinen, R.; Punamäki, R.L. (2005). *Perspectives on Activity Theory*. N. York, Cambride University Press

Foster, I. (2006). "Computer Commentary". *Nature*, vol. 440 (23 March): 419

Giddens, A. (1984). *The Constitution of Society: outline of the theory of structuration*. Polity Press, Cambridge, UK

Goedvolk, J., De Bruin, H. and Rijsenbrij, D. (1999). "Integrated Architectural Design of Business and Information Systems", *Proceedings of the Second Nordic Workshop on Software Architecture (NOSA'99)*, Ronneby, Sweden

Grover, V., Jeong, S.R., Kettinger, W.J.; Teng, J.T.C. (1995). "The Implementation of Business Process Reengineering," *Journal of Management Information Systems*, 12(1): 109-144.

Hammer, M. (1990). "Reengineering Work: Don't Automate, Obliterate," *Harvard Business Review*, July-August: 104-112

Hammer, M.; Champy, J. (Ed.) (2001). *Reengineering the Corporation: A Manifesto for Business Revolution*. London: Nicholas Brealey Publishing.

Hoogervorst, J.; Koopman, P. L.; Van Der Flier, H. (2002). "Human Resource Strategy for the New ICT-Driven Business Context". *International Journal of Human Resource Management*, 13 (8): 1245-1265

ISO (1995). *ISO/IEC 10746 ODP Reference Model.* International Standards Organization.

Kallinikos, J. (2004). "Farewell to Constructivim: technology and context-embedded action", in C. Avgerou, C. Ciborra, F. Land (eds), *The Social Study of Information and Communication Technologies*. Oxford University Press, Oxford

Kogut, B. (2000). "The Network as Knowledge: generative rules and the emergence of structure". *Strategic Management Journal*, 21 (3): 405-425

Kogut, B.;Zander, U. (1992). "Knowledge of the Firm, Combinative Capabilities and the Replication of Technology". *Organization Science*, 3 (3): 383-397

Kruchten P. (2003). *The Rational Unified Process: An Introduction*. Addison-Wesley, Reading, MA

Labovitz, G.; Rosansky, V. (Ed.) (1997). *Power of Alignment: How Great Companies Stay Centered and Accomplish Extraordinary Things*. John Wiley, New York

Lamb, R.; Kling, R. (2003). "Reconceptualizing Users as Social Actors in Information Systems Research". *MIS Quarterly*, 27 (2): 197-235

Laudon, K.; Laudon, J. (2000). *Management Information Systems*. New Jersey: Prentice Hall.

Leont'ev, A. (1974). "The problem of Activity in Psychology". *Soviet Psychology*, 13 (2): p. 4-33

Levina, N.; Vaast, E.. (2005). "The Emergence of Boundary Spanning Competence in Practice: implications for implementation and use of information systems". *MIS Quarterly*, 29 (2): 335-363.

Lewin, A. Y.; Long, C.P.; Carroll, T.N. (1999). "The Coevolution of New Organizational Forms". *Organization Science*, 10 (5): 535-550

Lewin, A. Y.; Volberda, H. W. (1999). "Prolegomena on Coevolution: a framework for research on strategy and new organizational forms". *Organization Science*, 10 (5): 519-534

Lindgren, R.; Henfridsson, O.; Schultz, U. (2004). "Design Principles for Competence Management Systems: a synthesis of an action research study". *MIS Quarterly*, 28 (3): 435-472

Malone, T.W.; Crowston, K.; Herman, G. A. (Eds) (2003). *Organizing Business Knowledge: the MIT Process Handbook*. Cambridge, MA: MIT Press

March, J. G. (1999). *The Pursuit of Organizational Intelligence*. Malden, MA: Blackwell Publishers

Maturana, H. (1988). "Reality: the search for objectivity or the quest for a compelling argument." *Irish Journal of Psychology*, 9 (1): 25-82.

Maturana, H.R. and Varela, F.J. (1980). *Autopoiesis and Cognition: the realization of the living*. D. Reidel Publishing, Dordrecht, Holland

Maturana, H.R. and Varela, F.J. (1987/1992). *The Tree of Knowledge*. Shambhala, Boston

McKelvey, B. (1997). "Quasi-Natural Organization Science". *Organization Science*, 8 (4): 352-380

McKelvey, B. (1999). "Complexity Theory in Organization Science: seizing the promise or becoming a fad?". *Emergence*, 1 (1): 5-32

Nardi, B. (1996). *Context and Consciousness: Activity Theory and Human-Computer Interaction*, MIT Press, Cambridge, MA

North, E., North, J. and Benade, S. (2004). "Information Management and Enterprise Architecture Planning: a juxtaposition". *Problems and Perspectives in Management* (4), p. 166-179

OMG (2005). "Unified Modeling Language: Superstructure, version 2.0". Object Management Group. Retrieved December, 15 2005, from http://www.omg.org/cgi-bin/doc?ptc/2004-10-02

Orlikowski, W.J.; Yates, J. (2002). "It's About Time: temporal structuring." *Organization Science*, 13 (6): 684-700.

Pereira, C. ; Sousa, P. (2005). "Enterprise architecture: business and IT alignment" in H. Haddad, L. Liebrock, A. Omicini, R. Wainwright (Eds.), *Proceedings of the 2005 ACM Symposium on Applied Computing (SAC)*, (pp. 1344-1345). Santa Fe, New Mexico, USA.

Pereira, C.; Sousa, P. (2004). "A Method to Define an Enterprise Architecture using the Zachman Framework" in H. Haddad; A. Omicini; R. Wainwright; L. Liebrock (Eds.) *Proceedings of the 2004 ACM Symposium on Applied Computing (SAC)*, (pp. 1366-1371). Nicosia, Cyprus.

Porter, M. (1985). *Competitive Advantage*. The Free Press, New York

Pawlowski, S. D.; Robey, D. (2004). "Bridging User Organizations: knowledge brokering and the work of information technology professionals". *MIS Quarterly*, 28(4): 645-672

Senge, P. (1990). *The Fifth Discipline:The Art and Practice of The Learning Organization*. Currency Doubleday, New York

Smith, H.; Fingar, P. (2003). *Business Process Management: The Third Wave*. Meghan-Kiffer Press, Florida

Sousa, P.; Caetano, A.; Vasconcelos, A.; Pereira, C; Tribolet, J. (2006a). "Enterprise Architecture Modelling with the Unified Modelling Language 2.0", in P. Ritten (ed) *Enterprise Modelling and Computing with UML*. IRM Press, Hershey, PA

Sousa, P; Pereira, C; Vendeirinho, R; Caetano, A; Tribolet, J. (2006b) "Applying the Zachman Framework Dimensions to Support Business Process Modelling". *Proceedings of the 3rd International Conference on Digital Enterprise Technology*, , Setúbal, Portugal, 2006.

Sowa, J.; Zachman, J. (1992). "Extending and formalizing the framework for information systems architecture". *IBM Systems Journal*, 31: 590-616.

Star, S. L. (1989). "The Structure of Ill-Structured Solutions: boundary objects and heterogenous distributed problem solving" in M. Huhn; L. Gasser (eds), *Readings in Distributed Artificial Intelligence*. Morgan Kaufman, Menlo Park, CA

Teece, D.J.; Pisano, G.; Shuen, A. (1997). "Dynamic Capabilities and Strategic Management". *Strategic Management Journal*, 18 (7): 509-633

Tribolet, J. M. (2005). "Organizações, Pessoas, Processos e Conhecimento: da Reificação do Ser Humano como Componente do Conhecimento à "Consciência de Si" Organizacional" [Organizations, People, Processes and Knowledge: from the reification of the human being as a component of knowledge to the knowledge of organizational self] in L. Amaral, R. Magalhães, C. C. Morais, A. Serrano, C. Zorrinho (eds). *Sistemas de Informação Organizacionais*. Sílabo Editora, Lisboa, Portugal

Tsoukas, H. (2005) *Complex Knowledge*. Oxford University Press, Oxford

Vygotsky, L. S. (1978). *Mind in Society: the development of higher psychological processes*. Harvard University Press, Cambridge, MA

W3C (2002). "Web Services: World Wide Web Consortium". Retrieved December, 15 2005, from http://www.w3.org/2002/ws/

Weber, M. (1978). *Economy and Society: an outline of interpretive sociology*. University of California Press, Berkley, CA

Weick, K.E. (1995). *Sensemaking in Organizations*. Sage, Beverly Hills, CA

Weick, K.E. (2001). *Making Sense of the Organization*. Blackwell Publishing, Malden, MA

Weick, K.E.; Roberts, K.H. (1993). "Collective Minds in Organizations." *Administrative Science Quarterly* (38:3), pp. 357-381.

Zachman, J. (1987). "A Framework for Information Systems Architecture". *IBM Systems Journal*, 26 (3): 276-292.