A Context-based Representation of Organizational Structures

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Abstract[1]

Traditional companies used to be authoritarian and built around hierarchical organizational charts. Facing more dynamic environments in recent history, many companies experimented with newer forms of organization, usually cutting down long decision paths and fostering lean structures able to react to rapid changes in the marketplace. We believe that the future of organizational structures lies in hybrid, dynamic models allowing enterprises to internally move from bureaucratic to adhocratic structures at will, according to changing contexts and focuses of attention.

This paper presents a four-level model representing organizational structures in a decision process, including social networks, enterprises, communities of practice, virtual communities and task forces. Then, it discusses how context intervenes in this four-level model and the role of context at each level. We illustrate our model and context in a scenario inspired by a real-world application.

Introduction[2]

Most of today's companies are built around organizational structures ranging from bureaucracy to adhocracy.

According to Weber, Henderson, and Parsons (1947), the attributes of a modern *bureaucracy* include impersonality and the implementation of a system of authority that is practically indestructible. Toffler (1970) sees it as a network of roles fulfilled by individuals (in opposition to a network of individuals, such as a social network). Bureaucratic organizations usually deal with routine operations.

At the other end of the spectrum, an *adhocracy* represents any form of organization capturing opportunities, solving problems, and getting results (Waterman 1992). Beairsto (1997) defines it as "the term used to describe the flexible structure of multidisciplinary teams which is best suited for complex tasks in a dynamic and unpredictable environment." It can be characterized by shared values across various splinter groups, cultures, and individuals. An adhocracy is not organized around formal rules or regulations, and it does not provide standardized procedures for dealing with routine problems. It is instead a response to environmental pressure (Mintzberg and Quinn 1996), meant to cope with exceptional

situations and adapt quickly to changes within its environment.

One crucial difference between both structures is the way information and knowledge flow inside the structure. In the bureaucracy, they flow bottom-up along a hierarchical path, before coming down again along a different hierarchy. In the adhocracy, hierarchical ties are relaxed and information and knowledge mostly flow through lateral relations (Orlikowski 1991).

This paper introduces a four-level organizational model whose goal is to show how an organization can dynamically move internally from bureaucratic to adhocractic structures, according to changing contexts and focuses of attention in its environment. This model is based on the explicit consideration of context in the representation of knowledge and reasoning, an approach rooted in knowledge-based systems and artificial intelligence (AI) research. This model identifies different types of context at different levels of generality. It is presented with greater detail in Gachet and Brézillon (2005).

This paper is organized as follows. The next section presents the four-level model representing organizational structures in a decision process. The following section describes how context intervenes in this four-level model. Then, we discuss the four-level model and the role of context in an example scenario, before concluding with a discussion of future research.

A Four-Level Model of Organizations

This section introduces a four-level classification model that explains how a structure at a given level can emerge from one or several lower-level structures. The discussion is lead on the basis of instantiations of organizational structures often discussed in the literature.

Figure 1 presents an integrative view of various organizational structures, including social networks, enterprises, communities of practice, virtual communities, and task forces. Gachet and Brézillon (2005) show that these different organizational structures can be organized in a multi-level model spanning from a less structured human level (at the bottom) to a more structured adhocratic level (at the top). Each level arises from at least one of the lower levels.

The next sections review the four proposed levels: namely the human, organization, community, and adhocracy levels. For illustrative purposes, each section describes at least one specific organizational structure belonging to each level.
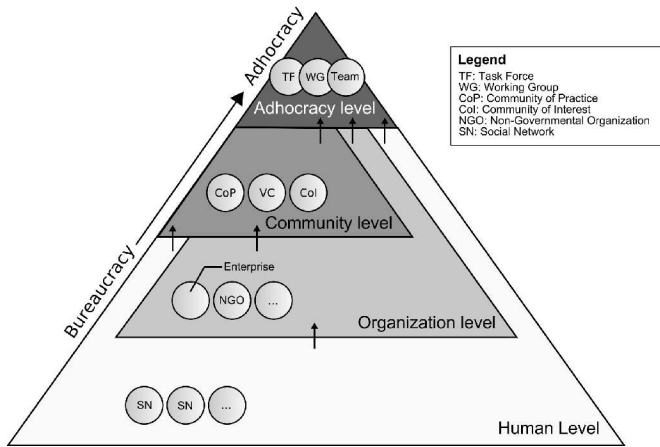

Figure 1. Four levels of organizational structures

Human Level

The *human level* plays a double function in our model: it supports and encompasses the other levels at the same time. As shown in Figure 1, it supports the other levels because individuals are the elementary constituents of the entire model. In other words, the three upper levels are made up of individuals inevitably coming from social networks belonging to this human level. However, it also encompasses the other levels, precisely because actors in an organization, a community, or an adhocracy still belong to their grass root human level. This distinction is important and leads to the immediate observation that individuals are in fact points in a system of reference where the three upper levels become three dimensions. An individual seldom belongs to only one level of the model; at any time, he belongs to several levels, but in varying degrees (Figure 2).

A *social network*, as a structure of the human level, is an organizational structure comprised of individuals and ties (e.g. Wellman and Carrington 1988; Hanneman 2001). The main characteristics of a social network are its flexible structure, a lack of hierarchy, and a socialization around individual goals. We hold that only a weak *discriminating factor* allows for the differentiation of individuals in the social network and individuals in the environment of the social network.

Ties between individuals of a social network can be of different natures: familial ties, lifelong friend ties, marital ties, business partner ties – all are important for people to obtain the fundamentals of identity, affection, emotional and material support (Rheingold 2000), i.e. the recognition of their existence by others. Ties are "socially-oriented" in many real life situations. Trust does not play an important part, and individuals generally belong to several social networks where they do not play crucial roles.
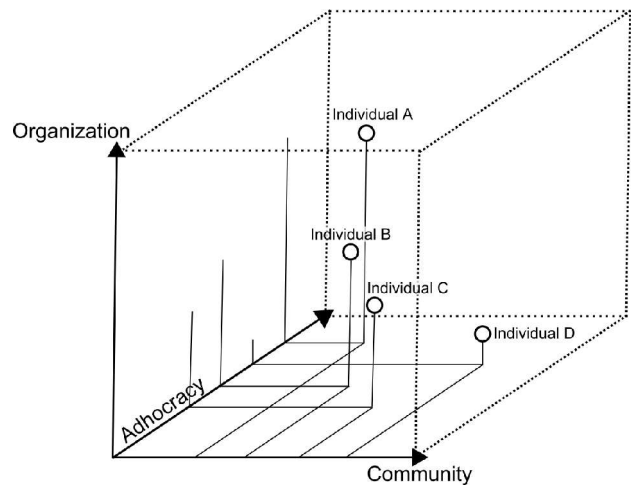

Figure 2. An individual operates on several levels

Organization Level

The meaning of the *organization level* is closely related to social perspectives. An organization is "a combination of human effort in a relatively stable network of social relations" (van Aken 1982). An organization is structured around a concern related to the organization itself (i.e. the enterprise). Therefore, the organization level is also closely related to bureaucratic concepts.

In an informal way, an *enterprise* (which in our model is an instantiation of the organizational level) is often described as a collection of organizations and people formed to create and deliver products and services to customers in a competitive marketplace. The term used in this sense encompasses corporations, small businesses, non-profit institutions, government bodies, and other kinds of organizations. Successful enterprises are organized around *shared visions*. This shared vision gives the enterprise an identity, even though individuals in the enterprise can follow independent, modular goals in their day-to-day activities.

Community Level

A *community* can be defined in a bottom-up fashion as a unified body of individuals emerging from an existing social network. Instances of such communities are communities of practice, virtual communities, communities of interest, communities of relationship, etc. As previously mentioned, communities are rooted in social networks. A community structure emerges when a focus on a specific domain arises among the individuals of an existing social network. This shared concern gives the community a collective context and individuals organize as actors with roles.

Communities of practice (CoP), as structures of the community level, are semi-structured groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis (Wenger et al. 2002). They have federated goals and shared contexts. We refer to this

Table 1. Comparison between the different levels and structures

	Human (SN)	Organization	Community	Adhocracy
Generating factor	Discriminating factor	Shared vision	Focus of interest	Mission
Entrance	By natural assimilation	Hiring	Free or by cooptation	By role-based selection
Exit	By natural rejection	Dismissal or voluntary exit	Free or by cooptation	After mission accomplished or canceled
Type of goal	Independent, individual goals	Independent, modular goals oriented towards the shared vision	Convergent goal; exchange of experience, information and knowledge	Shared goal; supply of information, knowledge, and experience.
Goal definition	None	Attain vision	Share domain interest, keep domain expertise; accept peer judgement	Accomplish mission
Members	Individuals	Actors (individuals + hierarchical roles)	Actors (individuals + roles)	Actors (individuals or digital entities + "on the fly" roles)
Members' autonomy	High	Medium (hierarchical authority)	Medium (peer pressure)	Weak (high integration)
Shared language	No	No, partial at best	Yes	Yes
Degree of organization	Weak, based on functional ties between individuals	Usually high, based on the organizational chart	Medium, based on the production/consumption balance of the actors	High, strongly related to the mission and the organizational context
Lifetime	Perennial	Long-lasting	Variable	Limited

domain of knowledge as a *focus of interest*. There is a kind of implicit structure in a CoP. In pursuit of the convergent goals inherent to the focus of interest, actors in a CoP employ common practices, work with the same tools and express themselves in a common language. Through such common activity, they come to hold similar beliefs and value systems (Lave and Wenger 1991).

A *virtual community* is another instantiation of the community level. It is typically depicted as a group of individuals who have regular contact with one another in cyberspace, with shared interests, problems or ideas, independent of space and time. Actors in a virtual community also tend to employ common practices, work on similar tools and use a common language. In short, they share similar belief and value systems.

Adhocracy Level

The term *adhocracy* is often used in opposition to the term bureaucracy. It describes a structural configuration that "is able to fuse experts drawn from different disciplines into smoothly functioning ad hoc project teams" (Mintzberg 1979). An adhocracy is not organized around formal rules or regulations, and it does not provide standardized procedures for dealing with routine problems. It is instead a response to

environmental pressure (Mintzberg and Quinn 1996), meant to cope with exceptional situations and adapt quickly to changes within its environment.

A *task force*, as a structure of the adhocracy level, emerges around an external, unpredictable event, in the well-defined context of the enterprise. Task forces are built on the fly and assembled around short-lived and highly contextual focuses of interest that we call *missions*. The entire task force is oriented towards its expected results and thus actors have a strong motivation in the realization of the mission and each actor assumes an active role to satisfy it. Roles are attributed to actors on the fly, according to the needs of the current context. In particular, as the context can change during the lifetime of a task force, roles (and the corresponding tasks) can be redistributed several times among the actors.

Table 1 summarizes the differences between the human, organization, community, and adhocracy levels according to several criteria.

Context in the four-level model

Brézillon and Pomerol (1999) consider three parts for the context of a focus, namely the external knowledge, the contextual knowledge and the proceduralized context. At a

Table 2. External and internal shared context at each level

	External Context	Internal Context
Human level	A cloud of contextual knowledge pieces; "free electrons" belonging to the collective memory Knowledge about upper levels, from where structured knowledge comes back	Describes the expected behavior in a social network Built progressively over long periods of time; low formalism Knowledge cannot be proceduralized directly. Instead, knowledge is proceduralized by a top-down movement from upper (more structured) levels
Organization level	Information about the human level General information about an organization, the rules of the market (e.g. supply and demand model)	Shaped around the vision of the organization Built slowly and progressively, forming an "organization memory" Loose Proceduralized from the external context of the organization Contains knowledge about the type of the organization, its size, its target market, its landmarks, key individuals, etc.
Community level	Information about the organization and human levels Implicit rules and correct procedure for building and maintaining a community inside the underlying organization (e.g. through a well-defined hierarchical channel) Past experience gained from former communities, results obtained, etc.	Shaped around the common benefit of the community Built progressively but at a fast rate, forming a "community memory" Low pressure from lower levels Specialized; leads to high cohesiveness Proceduralized from the external context of the community Contains knowledge about the kind of actors required, the type of problems addressed, current results and failures, etc.
Adhocracy level	All the information of the community, organization, and human levels General impacts and/or effects of adhocracies on the underlying communities and organizations Kind of organizational structures developed at that level	Intertwined with the mission of the adhocracy Created on the fly with the adhocracy itself High pressure from lower levels Dense; leads to strong cohesiveness Proceduralized from the external context of the adhocracy Contains knowledge about the authority of the adhocracy in the underlying organization, the way to mobilize resources from underlying levels, etc.

given step of a decision process, one distinguishes the part of the context that is relevant at this step of the process and the part that is not relevant. The latter part is called *external knowledge* (EK). The former part is called *contextual knowledge* (CK), and obviously depends on the agent and the process at hand. Always at a given step of a process, a part of the contextual knowledge is proceduralized to be used at this step of the process. We call this the proceduralized context (PC). The *proceduralized context* is the part of the contextual knowledge that is invoked, assembled, structured and situated according to the given focus. Thus, a given focus and its associated context are interdependent.

Structures at each level are associated with a shared context. Two levels must be distinguished in any shared context, namely the external context and the internal context. In general, the *external context* contains relevant information about the underlying levels and the environment of the organizational structure. The *internal context* is intertwined with the generating factor of the corresponding level (discriminating factor, vision, focus, or mission).

At the human level, individuals retrieve information explaining how to behave in the social network. However, this shared context contains very general pieces of contextual knowledge that individuals cannot transform directly in a proceduralized context for their individual contexts. For example, a piece of contextual knowledge in a society could be "any individual must pay taxes", but the relationships for the individuals between the taxes they pay and the actual administration of funds (e.g., lightning of the streets and police enforcement for the security) is not immediately perceived. Moreover, all individuals are not equal with respect to the amount they are taxed.

At the organization level, the internal shared context grows continually during the lifetime of the organization, building what is called the "organization memory". Its contents are very varied and include all the knowledge related to the organization.

Table 3. Organizational structures of the example scenario

Context	Social Network	Communities	Task force
Normal state	(All)	Several (based on the company organization chart)	(None)
Alert state	Company + Maintenance contractor	Manufacturing CoP (including employees, representatives of the manufacturer of the failing machine tool, maintenance dealers, etc.)	Specialized worker Shop foreman Production manager Maintenance expert
Design state	Company + Supplier	Executive committee of the company Manufacturing CoP	Maintenance expert Production manager Shop foreman Purchasing manager Inventory manager Director
Implementation state	Company	Manufacturing CoP	Director Decision Support System Shop foreman Specialized workers

At the community level, the internal shared context allows a strong interaction that facilitates information retrieval by any actor of the community and speeds up the briefing of new members. Contextual knowledge in a community represents specialized knowledge. As a consequence, actors in a community frequently use a highly technical language, knowing that other actors will understand it immediately. This specialized language (or shared context) allows the maximization of the communication bandwidth between actors of the community. Moreover, its understanding can be seen as a kind of barrier to entry for new members.

Finally, at the adhocracy level, the internal context is created and developed on the fly during the setting-up of the adhocracy. The social pressure within the enterprise on the adhocracy makes this internal context rich (large access of the adhocracy to the resources of the enterprise, for example) and gives a strong cohesiveness to the group. Table 2 summarizes the contents of the various shared contexts.

Example Scenario

The example scenario presented in Gachet and Brézillon (2005), even though simplified, remains in essence typical of organizational decision processes. The company used in the scenario is a typical, middle-sized manufacturing company (called Robots Manufacturing, Inc.) producing ten different types of robots. A problem is detected (a machine breakdown in the production line), people that will be involved in the decision gather, information is collected, alternatives are identified and evaluated, and a decision is made, implemented, and assessed to be sure that it does not lead to new problems. In this section, we revisit the informal presentation of the scenario using the four-level model introduced in the previous sections of this paper.

Whereas most definitions of a decision process start with the detection of a problem, we advocate a broader definition of the decision context, encompassing elements that exist and evolve even when the situation does not present exceptional events. We use the social networks paradigm (at the human level in Figure 1) to support this claim. In the context of Robots Manufacturing, Inc., there exists different social networks in association with possible discriminating factors. Examples of discriminating factors include "Working for Robots Manufacturers" (the company).

The Robots Manufacturers, Inc. enterprise is organized around a traditional hierarchical organizational chart and breaks up in departments and units. This natural partitioning of the company gives a good idea of the communities that emerge *intra muros*. For exemple, marketing people represent inside the company a structure that can be considered as a community of practice.

When the unpredicted machine breakdown occurs, a mission ("problem to fix") appears in the context of the company ("normal state") and moves the enterprise to a new context ("alert state"). Both the mission and its context have to be considered jointly. Both mobilize a new group of individuals (the task force) coming from social networks and/or communities (e.g., the manufacturing community of the enterprise). All the members of this new task force have a same concern for the mission and are sensitive to its context.

Actors organize their knowledge according to the mission. The production manager is able to proceduralize the contextual knowledge and to turn the event into some meaningful knowledge (in that case, retrieve the phone number of the maintenance contractor and ask an expert to come as soon as possible).

The maintenance expert, once on the site, translates the problem into a diagnosis and provides the company with a better understanding of the consequences of the failure in terms of duration ("the machine tool will be unavailable for about five days").

The maintenance expert, having pinpointed the exact consequences of the failure, moves the enterprise context from the "alert state" to the "design state", thus creating a new (mission, context) pair and, consequently, reshaping the

task force. In the design state, alternatives have to be identified and evaluated. The production manager proceduralizes the sensed knowledge ("machine unavailable for five days") into more useful knowledge ("30% reduction of capacity for production processes x and y") to propose a decision alternative that will be analyzed by the director. The director can in turn ask for the advice of other executives (for example, the shop foreman if the alternative changes the production planning, the purchasing manager if the alternative affects purchases, or the inventory manager if the alternative changes the expected storage quantities).

The production manager can produce as many alternatives as necessary, which can reshape the task force as often as necessary. However, once one of the alternatives is agreed upon by all the actors of the task force, the director fully assumes his role of decision maker and decides to implement the new plan. This moves the enterprise context from the "design state" to the "implementation state", thus creating a new (mission, context) pair and, again, reshaping the task force.

Table 3 summarizes the four (focus, context) pairs involved in our scenario, together with the corresponding social networks and task forces.

Concluding Remarks and Future Work

This paper has introduced a four-level model that can be used to explain how a company moves from one organizational structure to another when its context changes. As a basic model, however, the proposed paradigm still suffers from a number of limitations. In particular, it does not consider the sociological aspects related to the dynamic reshaping of organizational structures inside the company. It is obvious that a dynamic model of organization is socially transformative and its impact on the relationship between workers and work organization should be analyzed from the perspective of the sociology of work.

Another step in this research will be to leverage the proposed model in order to infer a framework of technology support adapted to the different organizational structures. We believe that each level of the proposed model can benefit from a different kind of support technology (for example, decision support systems (DSS) at the adhocracy level, computer supported collaborative work (CSCW) at the community level, management information systems at the organization level and office automation tools at the human level). Bringing these different categories of systems into a coherent framework could be a valuable contribution to the field of systems integration.

It is our hope that the model presented in this paper provides a vehicle for researchers to develop dynamic organizational models.

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