

Blazing the Trail or Follow the Yellow Brick Road? On Geoinformation and Organizing Theory

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Abstract. Over the last fifteen years, literature on the organizational aspects of Geo Information Systems (GIS) and Spatial Data Infrastructures (SDI) has been dispersed and it lacked a clear focus. This paper presents an analysis of that literature, using organizing metaphors. The implicitly underlying metaphors and paradigms are categorized and provide a framework for analysis. Based on the outcomes, a brief outline of a possible research agenda for organizational aspects of geoinformation is given.

1 INTRODUCTION

Geoinformation is mostly managed within Geographical Information Systems (GIS) and Spatial Data Infrastructures (SDI's). Implementation processes focus mainly on technology and (spatial) data¹. SDI policy advisors are aware of organizational aspects most of the time, but do not consider them as important, let alone they treat them as manageable phenomena (Georgiadou, Puri et al. 2005). Developing a GIS or SDI has been treated as an implementation process standing apart from, rather than being a part of organizational change. Of course, every now and then implementation projects have their delays, disappointments, pitfalls and setbacks, but in a technical sense, they are delivered up and running.

The myth that everything the user needs can be built without any limitation still seems to be alive. Implementation specialists give us the impression that all problems can be solved with technology, thus no attention is given to the post-implementation period, when a GIS or SDI gets its real life test. Implementers seem to be insensitive to organizational consequences, a relationship between SDI implementation and organizational change is not perceived. Organizational structures, modes of cooperation and work relations are no subjects for the SDI implementer.

¹ A GIS is treated here as a system for intraorganizational spatial data, an SDI as infrastructure in an interorganizational environment. The two entities, systems and infrastructures, are different in nature but both vehicles for disseminating geoinformation. In this article no distinction is made between the two as far as organizational theorizing is concerned.

However, developments over the last fifteen years suggest a slow but steady growing inclination of implementers to take organizational aspects more into account, while laying less emphasizing on technology. Consequently, researchers have gained interest in studying the relationship between GIS or SDI and the organizations that are involved in them. The main research focus, however, remained on the implementation process, i.e. the effort to get hardware and software up and running for disclosing data. Ideas, theory and models to guide that were borrowed from political science, economy, the management information systems (MIS)-discipline and the like. While these theories have been of great value to GIS and SDI implementation, however, they do not cover the post-implementation period.

The advancement of SDI has made implementation processes more complex². Probably because SDI's are moving across organizational boundaries, appealing projects take longer than expected, are delayed or sometimes even cancelled. The most striking fact is that practitioners point at organizational impediments, but do not know how to deal with them.

This paper will focus on how GIS and SDI relate to organizing theory. First, a framework for the analysis of literature on this topic will be provided. Next, an enumeration of literature that deals with organizing in the realm of GIS and SDI will be given³. Then it becomes clear that the selection of organizing theories to be used to guide GIS and SDI implementation have been rather one sided, using mainly conservative theories. Finally, a conclusion will be given with some suggestions for a possible research agenda.

The topic of this paper emerged while the author monitored the development of the Dutch Geoportal Network⁴. During meetings and discussions of the coordination board, individual members were willing to advocate a more organizational approach, but had no idea how to do that. While studying relevant literature, it became clear that there is no consistent line of thinking as far as organizational aspects of GIS and SDI are concerned. That observation has led to the analysis which forms the body of this paper.

² In respect to this paper SDI is treated as a national project, moving across organizational boundaries, covering the realm of interorganizational relationships.

³ Organizing theory is a better definition than organization theory, because it refers to a process, not an artefact.

⁴ The project is described in:
Zevenbergen, J., M. Hoogerwerf, et al. Connecting the Dutch Geo-Information Network–Liberty United. UDMS. Aalborg, Denmark.

2 PARADIGMS, METAPHORS, AND THEORIZING

The improvement of organizing theories is not a one way, straightforward process, but a developing and expanding world of thoughts, ideas and paradigms, trying to anticipate on the problems at hand. The following part will make an attempt to make sense of that process. Furthermore, it will provide a metaphorical tool, which can be used to analyze GIS and SDI literature on organizing.

2.1 Metaphor as an Organizing-Theory-Investigating Tool

Over the years, attempts have been made to describe changes and developments to make sense of the organizing theory development process from a sociological perspective (Ritzer 1975) (Donaldson 1985). It has created debate among sociologists, but also other social sciences were involved (Hassard 1993). Burrell & Morgan gave this intrinsically sociological debate a more philosophical basis (Burrell and Morgan 1979). A more practitioner-oriented book that gained recognition among both scientists and practitioners, based on the analysis of Burrell & Morgan was 'Images of Organization' by Gareth Morgan (Morgan 1986). Morgan offered an analysis based on different metaphors that can be identified studying the historical development of organizing theory. Beyond a theory, a metaphor can be identified that represents a certain worldview. Morgan has been using metaphors like, among others, machines, organisms, cultures and brains to make sense of all the different organizing theories available.

This line of thinking stemmed from a thorough sociological analysis (Morgan 1980). Metaphors have been treated here as a way to view the world, in that sense it has paradigmatic qualities. Morgan has been using the paradigm in the way Kuhn defines it (Kuhn 1962). Here, paradigms are representations of alternative ways to view reality on a more general level, providing a framework to categorize metaphors. Metaphors are in this respect both ways of viewing the world and representing schools of thought, incorporating specific theories as heuristic specific problem solving activities. While a model is most of the time a rigid prescription of reality and is therefore lacking heuristic qualities, it can by no means be treated as a theory here.

To demonstrate the relationship between theories and metaphors, we can make a reference to the founding fathers of organizing science. Fayol, Taylor and Weber were the first organizational theorists to gain recognition. They have been developing their theories from a way of viewing the world as if it was a machine. A machine needs to be tuned in order to function as optimal as possible, external relationships are not identified (Morgan

1986). The machine–metaphor depicts the pursuit of rationality within organizational boundaries, of which the theories of Fayol, Taylor and Weber are clear examples.

Another example comes from the sociologist Herbert Spencer, who already in 1873 has been referring to an organization as an organized body. An organism needs nutrition and has therefore a relationship with its surroundings, so this metaphor is focused on the relationships of the organization with its environment. Like animals adapt themselves to their environment, organizations do the same. Theories in this vein became popular in the slipstream of the Hawthorne studies (Roethlisberger and Dickson 1939) (Morgan 1986). Lawrence & Lorsch developed a theory about organism and environment being dependent upon each other. Therefore, organizations need resources to produce and customers to sell their product to. (Lawrence and Lorsch 1967). Another theory within the organism-metaphor is the population ecology theory by Hannan and Freeman. They presume the same variety and selection mechanisms in organizing as in nature (Hannan and Freeman 1977).

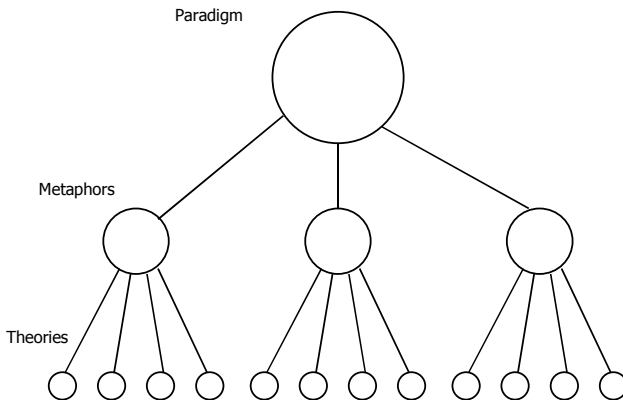


Figure 1: The relationship between paradigms metaphors and theories (adapted from Morgan 1980)

Figure 1 gives an impression of how paradigms, metaphors and theories relate to each other. More than one metaphor can be a representation of a paradigm and multiple theories can be identified within a metaphor. The metaphor is an elegant connection construct between a broad paradigm and a specific theory.

The argument that a theory is based upon a certain worldview is thoroughly elaborated by Burrell and Morgan (Burrell and Morgan 1979). They described all metaphors and categorized them into four paradigms (figure 2.) The categorization of paradigms is based upon two dimensions: the objective-subjective dimension and the regulation-radical change dimension. The four paradigms - functionalist, interpretive, radical-humanist and radical structuralist - reflect corresponding schools of thought.

The *functionalist paradigm* treats society as a concrete, real world with a systemic character. Behavior is bounded in that real world of tangible relationships.

The *interpretive paradigm* assumes that the social reality does not exist, it is the product of subjective experience. The world can be understood through the eyes of the participant, rather than that of the observer.

The *radical-humanist paradigm* emphasizes that reality is socially created. But while reality is constructed, at the same time human beings become part of it and they feel as if they are imprisoned by it. In that sense reality, like for example capitalism, is viewed as ideological domination, molding technology, logic, science, etc.

The *radical structuralist* paradigm focuses on society as a real and concrete dominating force. It is concerned with the way those in power seek to maintain their position.

As shown in figure 2, all metaphors can be linked to one of these paradigms. Metaphors are in this respect powerful intermediary concepts to link the precise character of theories to the more abstract character of paradigms.

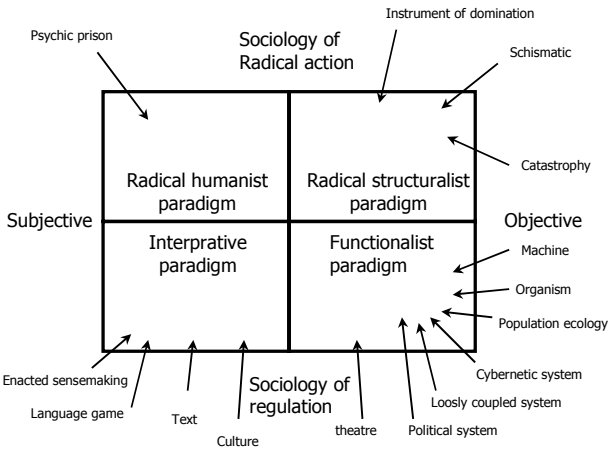


Figure 2: Paradigms and metaphors (adapted from Burrell and Morgan 1979)

2.2 A Perceived Paradigm Shift in Organizing Theory

According to Kuhn, a paradigm is a way to view the world and a set of beliefs to make sense of it. A scientific community cannot function properly without it (Kuhn 1962). Therefore, as Smircich puts it, based on Cassirer's 'curse of mediacy': "Data only becomes significant when they are made sensible and coherent through the mediation of human meaning." (Smircich 1983:164).

The four paradigms we have identified can be linked to Kuhn's model of scientific revolutions (Morgan 1980). In the analysis provided by Morgan, the functionalist paradigm and the radical structuralist paradigm can be treated as normal science, the objective-subjective breakthrough is a revolution and accordingly, the interpretive and radical humanistic paradigm are the result of a breakthrough to revolutionary paradigms (figure 3).

The approach provided by Kuhn gained critique and was subject to scientific debate (Lakatos and Musgrave 1970). Of course, there are comments to make about the way Morgan connected his approach to the Kuhnian definition of scientific revolutions. Two remarks are made here, symbolizing lots of other literature on this topic. There is certainly a boundary problem here since it is hard to define the start of a revolutionary science. Subjective theories in organization science might start at a certain

point, but they have their origins in anthropological theories, going back to the beginning of the 20th century. Consequently, a time wise indication of a paradigm shift can hardly be made.

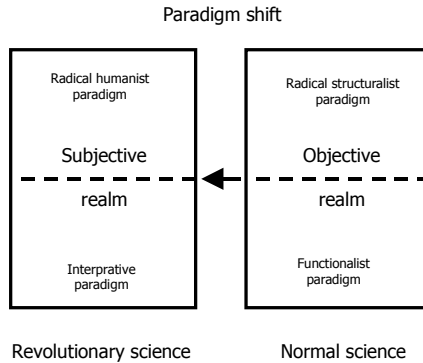


Figure 3: The paradigm shift

Paradigms do not develop in splendid isolation. They can influence each other without some revolutionary science will ever occur. We will close the discussion by stressing that Kuhn's ideas are valuable here, but not in a theoretical sense (Morgan 1980) (Hassard 1993). Morgan could have elaborated more on the critique mentioned before, but did not do so, probably because he treats the transition from normal science via crisis to revolutionary science as a metaphor itself. The shift of paradigms is in his arguing more a way to look at reality than a scientific exercise evoking scientific debate.

That is exactly the way this paradigm shift is used: as a metaphor of the advancement of science. The metaphors presented in figure 2 will provide a frame of analysis to investigate organizational literature considering the geoinformation community, GIS and SDI.

The framework discussed in this section will be used for analyzing organizational literature concerning GIS and SDI. Every publication will be scanned and connected to a metaphor, which is in turn connected to a paradigm. Sometimes this can be done because a specific theory is mentioned that connects to a metaphor. In most cases, however, this must be done by content analysis of the text. To shed some light on this procedure, each piece of literature that is added to the analysis will be introduced briefly in section 3.1., depicting the metaphor used by the author.

3 ORGANIZATION IN SDI LITERATURE

Every implementation of an information system comprises organizational impacts. Projects need to be managed, future users prepared for their new job and role. It is a complex and demanding operation that will seriously affect the organization at stake. How the (international) geoinformation world thinks about this topic can be learned from literature. Handbooks and research reports have been examined in order to assess the organizational mindset offered to the GIS and SDI community.

The time frame we are looking at is roughly between 1990 and now, covering a period of increasing organizational awareness. All literature known and available to the author was used, international and local, both ‘cookbooks’ and research. In table 1 all reviewed literature is summed up, categorized according to paradigm and metaphor. Section 3.1 contains brief descriptions of the literature under investigation mentioned in table 1.

Table 1: List of paradigms, metaphors, author(s), and year of publication

Scientist	Paradigm	Metaphor	Year
Aronoff	Functionalist	Machine	1989
Grimshaw	Functionalist	Machine	1991
Obermeyer & Pinto	Functionalist	Machine	1994
Assimakopoulos	Functionalist	Machine	1997
Higgs	Functionalist	Machine	1999
Nedovic-Budic	Functionalist	Machine	1999
Rajabifard & Williamson	Functionalist	Machine	2001
Fox	Functionalist	Organism	1991
Huxhold	Functionalist	Organism	1993
Pinto & Onsrud	Functionalist	Organism	1995
Meredith	Functionalist	Organism	1995
Azad & Wiggins	Functionalist	Organism	1995
Nedovic-Budic	Functionalist	Organism	1996
Reeve & Petch	Functionalist	Organism	1999
Walsham & Sahay	Functionalist	Organism	1999
Van den Toorn & de Man	Functionalist	Organism	2000
Harvey	Functionalist	Organism	2001
Rajabifard & Williamson	Functionalist	Organism	2002
Rajabifard, Feeney & Williamson	Functionalist	Organism	2002
Rajabifard & Williamson	Functionalist	Organism	2003
Nedovic-Budic, Pinto & Warnecke	Functionalist	Organism	2004
Craig	Functionalist	Organism	2005
De Bree & Rajabifard	Functionalist	Organism	2005
Obermeyer	Radical Structuralist	Domination	1995
Campbell & Masser	Interpretive	Culture	1995
Georgiadou	Interpretive	?	2005

3.1 Overview of GIS Literature on Organization

3.1.1 Literature based on the functionalist metaphor

This section summarizes all literature labeled as functionalist, meaning that it focuses on real structures, in most cases these are the (geo) information systems in an organization.

3.1.1.1 The machine metaphor

The focus within the machine metaphor is internal, focusing on literature that is aimed at rationalizing the organization from an internal perspective.

Aronoff provides a view in implementation of GIS focusing on a variety of aspects concerning introducing and managing GIS, including organizational aspects (Aronoff 1989). He states that GIS will affect the way things are done in an organization, but he does not make clear what will change and how. His focus is on the internal database management system (DBMS); all management activities are in some way related to that concept.

Drawing upon information strategy insights, Grimshaw connects information strategy with GIS (Grimshaw 1991). In order to do that, he comes with an implementation model that addresses questions that should be asked to develop such an information system and connect it with organizational aspects. Only internal features of that system are considered here.

Obermeyer & Pinto give a management definition based on a study by classic organization theorist Henri Fayol. This study provides five primary roles of management: planning, organizing, supervising, staffing and controlling (Obermeyer and Pinto 1994). According to Obermeyer & Pinto, management information system (MIS) is meant to satisfy a manager's need for information in respect to the roles mentioned. Thus, a MIS needs to enhance the effectiveness of decision, providing managers at all levels in an organization with adequate information. A MIS is seen as the hub in the wheel, surrounded by subsystems for geography, finance, and human resources, representing the spokes.

Assimakopoulos uses network analysis to give a description of the Greek GIS community (Assimakopoulos 1997). The research shows that land surveyors form the dominating professional group here. It could be an explanation for the technical orientation, which is expressed by emphasizing geometry, data quality and digital map production. The object of research is the GIS community, no external relationships are perceived, so the applied theory is internally oriented.

Higgs describes the use of geo-information in the Water project in Wales (Higgs 1999). Organizational problems are mentioned and explicated, but

do not play a role in the discussion and conclusions of information structures. The chosen perspective is internal.

In 1999 Nedović-Budić attempts to build a conceptual framework for management of GIS activities, based upon a brief review of relevant literature, stemming from multiple schools of thought (Nedović-Budić and Pinto 1999). The focus is on the organization, with coordination mechanisms like structure, process and policies in particular. In another article this concept is broadened with notions about standardization, interoperability, cost-of-coordination and mechanisms for GIS-sharing (Nedović-Budić and Pinto 1999). The overall perspective is internal again.

While pointing at the role of people and data in SDI, Rajabifard and Williamson see data as the main organizing factor (Rajabifard and Williamson 2001). Because data has different levels of aggregation, these differences dictate the way organizing takes place. The perspective is internal again, because the SDI environment is the object of analysis.

3.1.1.2 The organism metaphor

The organism metaphor sees organizations rationalizing themselves internally, with a focus on external relationships.

In his analysis of institutional issues of spatial information in Asia, Fox identifies contingent, external factors affecting the internal organization, like social, economical and political factors (Metz Fox 1991).

Huxhold explores the relationship between information systems and GIS (Huxhold 1993) (Huxhold and Levinsohn 1995). He asserts that theories used in information systems research can be applied in GIS research without restrictions. In that respect he develops a framework where the source of control (IS department, user department or top management) is determining the state of development of a GIS. With a traceable influence of Nolan's stage model, it gives a hint for exploring the relationship between management involvement and GIS use. There is, based on management literature from Moss Kanter, Peters & Waterman, Schein and others, a suggestion about organizational change (Huxhold and Levinsohn 1995). Environmental factors do play a role here, however, a minor one.

Pinto and Onsrud deliver a model based on the process of information sharing (Pinto and Onsrud 1995). Using concepts of political science and organization science, they identify a set of facilitators and some benefits, both internal and external.

Meredith quotes public administration theorists Thompson and March & Olsen and notices that an organization is complex, interdependent and in need for coordination (Meredith 1995). According to Meredith, the inter-

organizational context should be incorporated in this framework. Rational organizations seek structure and coordination, while rapid changing technology, which is the case in a GIS environment, is challenging this process. Because decisions are often made under ambiguous conditions, Meredith tries to identify internal and external conditions for participation, eventually put together in a framework.

Azad and Wiggins consider geographic data sharing as an inter-organizational aspect (Azad and Wiggins 1995). In their view, based on research by organization theorists Pressman & Wildavsky, an inter-organizational relation has implications for autonomy. A three-step model is suggested. Geographic data sharing, treated as an inter-organizational relation moves from collaboration to cooperation, eventually to coordination.

Nedović-Budić and Godschalk investigated the adoption of GIS in local government agencies (Nedovic-Budic and Godschalk 1996). They come with some external factors influencing GIS adoption and are trying to assess if and how they play a role.

Reeve & Petch are aware of the lack of organizational attention (Reeve and Petch 1999). They promote in their book a socio-technical approach, with the main message to put people first. In a narrative way they make their point that implementing GIS technology is a success-factor, depending on the way people work with it and how it will be managed. They draw a picture of GIS users, formerly constrained in their relation to technology by analysts and programmers but now with unmediated access to technology. Expectations about information systems shifted consequently from plain cost effectiveness to strategic advantages. These notions are used to develop a GIS Systems Development Methodology.

While mentioning literature on structuration (Giddens) and social construction of technology (Bijker et. al.) as influential, Walsham and Sahay stick to actor-network theory on an inter-organizational level when it comes to investigating GIS in district-level administration in India (Walsham and Sahay 1999).

Van den Toorn & de Man describe cultural factors influencing organizational structural factors, while using a cultural approach, which suggests an interpretationist propensity (van den Toorn and de Man 2000). Because they focus on (national) culture, influencing internal (objective) structure, their approach must be treated as a representative of the organism metaphor.

Harvey puts the actor network of the professional GIS-user in the center of the technology proliferation process (Harvey 2001). His approach needs

to be distinguished from social network theory, because it incorporates all network activities, including the technological ones. Based on research in Switzerland, he asserts that actor networks and technology, and in this case GIS-technology, affect one another. Data exchange stimulates the emergence of effective inter organizational de facto standards. They help to maintain actor networks, while prescribed standards do not work and will consequently not have impact.

Rajabifard and Williamson see cultural and social factors as contingent to the development of SDI (Rajabifard, Feeney et al. 2002; Rajabifard and Williamson 2002; Rajabifard and Williamson 2003). Contrary to the cultural metaphor as mentioned in section 2, culture is used here as an external influence, together with political, technological and economical factors.

An article by Nedović-Budić, Pinto and Warnecke presents research on both internal cooperation within and external cooperation with development and exchange of geo-information between organizations (Nedović-Budić, Pinto et al. 2004). Saving resources is the main driving force, leading to simple relationships with locally developed standards. External and internal relationships are different in nature. External relationships are more formalized, less intensive, more externally standardized according to recognized standards, fee-based, financially motivated and legally encapsulated compared to internal relationships.

Craig asserts that structure is not as much a success factor for GIS implementation as is the motivation and role of key individuals (Craig 2005). He depicts a few cases where individuals in his view were the enablers and driving forces of successful implementation of GIS.

Focusing on the wider community, De Bree and Rabajifard propose the use of mass communication to let users become more aware of SDI (de Bree and Rajabifard 2005).

3.1.2 Literature based on the radical structuralist paradigm

This paradigm considers organizations having deteriorating aspects. Eventually organizations will collapse due to internal properties.

3.1.2.1 The instrument of domination metaphor

Nancy Obermeyer offers in ‘The Hidden GIS Technocracy’ a perspective on GIS with both centralizing and decentralizing tendencies (Obermeyer 1995). Proliferation of GIS makes spatial data more available enhancing democracy. On the other hand standardization causes more centralized control of data and metadata. Ultimately, she argues, the centralizing developments will prevail, causing a domination of technology, which moves power away from user organizations.

3.1.3 Literature based on the interpretative paradigm

Georgiadou, Puri and Sahay propose to move away from traditional ways of looking at NGDI research (Georgiadou, Puri et al. 2005). According to them, revenues from SDI development are not as big as they should be. They name a few fallacies in traditional reasoning when it comes to SDI development. By proposing an alternative, they focus on questions concerning dynamics, process and scope and research regarding SDI development. This line of reasoning is elaborated further by trying to learn from the available body of knowledge regarding National Information Infrastructures (Georgiadou 2006).

3.1.3.1 The culture metaphor

Campbell & Masser address the topic of organization and technology (Campbell and Masser 1995) by mentioning two different cultural frameworks. There is one based on Greek Gods by Charles Handy (Handy 1985) and one based on a systemic analysis by Paul Frissen (Frissen 1986). With these organizational and cultural frameworks in mind, they distinguish different roles and styles of culture, influencing SDI.

3.2 Analysis

At first glance the striking fact of the provided overview is the diversity of approaches presented in order to deal with organizational aspects of the GIS implementation process. Political theory, MIS-organization, bureaucratic theory, management theory, all these different approaches are used to serve one goal: to explain the relationship between organizations and SDI. But the abundance of insights might scare off the practitioner, because the overall picture presented by the literature is neither consistent nor clear. The lack of consistency is particularly confusing because almost all authors pretend to have the ultimate solution to organizational analysis.

Another striking fact is that conservative organizing theories still guide management perspectives. Theorists like Weber, Fayol and Taylor developed their ideas about a century ago, attempting to structure the then anarchy within organizations, which was common in those days. These theories stress central control (Fayol), structure (Weber) and efficiency (Taylor). They are useful building blocks for advancing theories on organizing, but are not ready-to-use explanatory concepts anymore to be used in contemporary research (Hofstede 2004) (Morgan 1980).

There is no evidence that the reviewed literature gives any notions about strategy. Of course, some thoughts are shared about efficiency, but basic assumptions about how GIS can be used in organizations and how this affects the way things are done are absent. Most authors give us the impres-

sion that after organizations implement a GIS or when an SDI is promoted, organizational aspects are not involved. Just to name a few issues in the functionalist paradigm: task structure, organization structure, customer profiles or strategy are not mentioned. In this perspective implementation is a one-night-show, not an ongoing process.

3.2.1 Paradigm and metaphor

When we look at the paradigms involved, the Functionalist Paradigm is dominant, with only two exceptions in the Interpretive Paradigm and one in the Radical Structuralist paradigm. Organizations are mainly seen as objects, where tangible system features are measured and eligible for intervention.

Within the functionalist paradigm, only machine and organism metaphors are found. Studies using the machine metaphor focus on internal features, looking for internal explanations only to explain the performance of organizations. Authors moving within the organism metaphor connect the environment explicitly and seek explanations in the interaction between the organizing entity and its environment, focusing on real structures. The relationship of organizations with their environments is focusing on users, stakeholders, government and the like.

The Radical Structural Paradigm is focusing on deteriorating aspects of organization structures, which can be found in the Instrument of Domination Metaphor, of which the article by Obermeyer is a good example. She warns for the negative effect of centralization and standardization tendencies, which can have negative effects on user relations.

Literature originating from the interpretationist paradigm tries to look at the world from a participant perspective. Here there is no real world that can be observed but only interpretations of that reality. Campbell and Masser offer a cultural approach by summing up some cultural theories and Georgiadou et al. are working on an interpretationist perspective, borrowing from insights developed in information systems theory. Both articles propose to move away from the 'classic' systems approach and give some hints for alternative research strategies, but also lack a focus, let alone a research agenda of some kind.

4 DISCUSSION AND CONCLUSION

In this paper all the literature known and available to the author from the last two decades on organizing theory and geoinformation was analyzed. An adapted theoretical perspective on paradigms, metaphors and scientific

revolutions was used, based on insights provided by Burrell, Morgan and Kuhn. In literature on analyzing and explaining organizational issues concerning GIS and SDI, theories holding a functionalist paradigm are used, either using the metaphor of organizations as machines or organizations as organisms. Theories within this realm adhere to the assumption that the organization is a real object with a systemic character and interventions should be implemented accordingly.

While to date organizational theorizing is moving towards other paradigms as described by Burrell and Morgan, SDI and GIS are almost exclusively studied from the functionalist paradigm. The two contributions in the interpretationist paradigm represent the possible dawning of a tendency to break away from the safe, objective artefacts to subjective non-tangible terra incognita, hopefully establishing new organizational perspectives. If we observe that GIS and SDI development is still formulated in terms of system design and intervention, while there is hardly any knowledge about social processes involved, new approaches should be tried.

If we define this in Kuhnian terms, the scientific revolution is the movement from the objective (functionalist and radical structuralist) paradigm to the subjective (interpretationist and radical humanist) paradigm (figure 3). Looking at organizing theory in general, there is the existence of a paradigm of normal, objective science and a breakthrough to revolutionary, subjective science as visualized in figure 3. Speaking about organizing theory used to analyze GIS and SDI that is hardly the case. The few attempts with subjective paradigms described here are far from full grown.

4.1 Implications for Research

When there are still people working on geoinformation projects tangled up with organizing aspects a change is needed. With only intervention strategies affecting the organizational structure they obviously do not have the proper instruments to face the interplay between geoinformation and people. Implementers ought to have a palette with different analyzing and intervention skills available. Because non-structural solutions are hardly considered, that section of the palette has to be developed.

Translating that suggestion into the terms of this paper, we should make a paradigm shift to get a better understanding of organizational aspects. In that sense the encounters with the interpretationist paradigm are warmly welcomed. They can be trailblazers for the movement towards a revolutionary science, at least as far as the GIS and SDI realm is concerned. What is considered as a revolutionary paradigm for GIS and SDI, is already orthodox in general organizing science (Burrell and Morgan 1979). In that sense the GIS and SDI community can benefit from paradigms that revolu-

tionary for the geoinformation sector, and at the same time proven in general organizing terms.

Looking at perceived problems in GIS and SDI practice, theory advancement in organizational GIS and SDI research is needed. Still little is known about how the use of geoinformation and the implementation of GIS and SDI affects the way it is interpreted. Also the relationship with users and user groups has to be investigated. We can learn a lot more about the interplay between flexible organizations and rigorous data structures by focusing on people's perceptions, motives and expectations than just looking at what design of organizational structure is most effective.

This calls for unorthodox researchers, willing to use unfamiliar theories to address these issues. Because researchers familiar with an organizing background are scarce in SDI research, they have to be invited from disciplines like sociology, anthropology, psychology and public administration. That scholars from other disciplines are able to do groundbreaking research in a technical environment is convincingly demonstrated by the anthropological study of a technical culture by Kunda (Kunda 1992).

4.2 Conclusion

This paper is an invitation to researchers keen on organizing subjects to investigate processes concerning GIS and SDI development. Contemporary developments in organizing theory should be applied to this topic to gain a better understanding of inter-organizational aspects of GIS and SDI. This line of thinking is desperately needed to move away from the objective, functionalist paradigm to subjective paradigms incorporating interpretive and radical humanist approaches. By doing that, a body of knowledge will develop advancing GIS and SDI. The revolutionary literature provided by Campbell & Masser and Georgiadou et al. are a clear signal of the willingness to make that happen. A whole body of knowledge in, for instance, cultural research is waiting to be applied in the world of geoinformation.

4.3 Acknowledgement

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