

## **Structuring Lay Knowledge in a GI Perspective: Problems and Pitfall**

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### **ABSTRACT**

The present contribution, starting from some considerations developed in environmental planning domain, discusses the representation of lay knowledge in a GIS environment. Two paths of exploration in dealing with representational problems are sketched. The first is concerned with the structuring of an acquired cognitive base and, the other is about the implementation of cognitive routines. In particular the structuring process of a lay cognitive base is discussed starting from recent developments in GIS technologies and information theories. Difficulties and pitfalls, which arouse during a case study related to an environmental planning experience being carried on for a national natural park, are presented. The experimentation work is discussed also in relation with a preliminary attempt of outputs validation carried out with people who, in a preliminary stage, were interviewed in order to acquire lay knowledge.

### **1 REPRESENTATING LAY/LOCAL KNOWLEDGE: A GENDER PERSPECTIVE ON THE ALTA MURGIA PARK**

In planning practice, seen as a constructive process based on dialogue between different knowledge domains, the lay, informal one is considered a precious source for contextual knowledge and its embedded values regarding local environment. As communicative planning practices have highlighted, the dialogue between expert and lay knowledge can only improve the ability of planners and communities in interpreting a specific planning context and in identifying possible future paths of effective action (Maciocco, 1999). Moreover lay people together with experts can and should reciprocally learn through interaction and discover ways to develop understanding and managing of different planning problems (Forester, 1989; Friedmann, 1987). From this point of view knowledge and information can no be longer taken as steady, permanent base exclusively recognisable in the technical-expert domain. On the contrary, they are the result of ongoing restructuring processes triggered by interplay between different policies, actors and knowledges.

In environmental planning, local knowledge has been recognized as the ground on which to base effective planning practices. It is necessary both to assure the success of the planning process and to recover local sustainable practices of transformation and use of the environment. This is much more necessary in regions where development processes seem to have ruptured human/environmental

relationships and where the “local”, which represents the coexistence of cultural and biological diversity, could be considered completely lost.

In these regions, as in the case of Apulia (South Italy), environmental planning and management is an opportunity to rediscover cultural and biological diversity because it represents a crucial resource to recover and preserve environmental values at the same time reorienting and assuring the economic development of local communities in accordance with those values. In particular, in rural parks, knowledge about agricultural systems and local knowledge, and capacity to manage and use diversity are complimentary aspects of conservation, and essential for the maintenance of long-term production (Shiva, 1997). Local knowledge needs not only to be recovered, but also documented, and then maintained as an ongoing management process in communities.

This paper focuses on the setting up process of the National park of Alta Murgia a large rural area in Apulia which was started in 1998. The set-up of the National park is the result of a long period and a conflictual process in which environmental protection had been seen as the only way to protect this rural area but, at the same time, as a way of limiting the agricultural development of this marginalised economy. For a long time the Alta Murgia has been considered as one of the marginalised areas in the difficult economic development process in Apulia which, taken as a whole, has suffered from economic differences between the North and the South. The Alta Murgia could be depicted as one of the agricultural non urbanised spaces in this region, which, instead, is now emerging as a central-crucial place, since it has become the epicentre in different relations and activities which have been added to the previous exclusive focus on the environmental protection (Barbanente, in press). In the Alta Murgia different politics and programs have been and are being implemented, as in other Apulian contexts where ecological modernization processes interact with restructuring processes of local economies determined by the European and global framework of action, and with changing ways of thinking about spatial planning.

The major changes in this area appear contradictory: on the one hand a bottom-up effort can be seen aimed at redefining the meaning of places abandoned for a long time but rich in affective, natural and historical values, and at identifying local resources; on the other the persistence of a renewed vision which considers the environment as an “object” for consumption and economic profit and detached from people looking after it (Barbanente, in press).

In particular this paper is concerned with the former kind of change. This is due to two main reasons: the first regards the need to recover and represent lay knowledge, which, even in places where salient histories have been lost, may embed environmental values recognizable through stories and affectivities that local people attribute to places; the second reason concerns the request for a new approach to local policy-making processes which need to be redefined in order to allow new projects and opportunities to be discovered/rediscovered and implemented. The whole goal is then not only to represent lay knowledge as a relevant part of the local context, but

above all, to help a socio-environmental changing context to structure and re-represent problems in a different way from the past considering different perspectives and voices. In fact the changes occurring in the political-economic framework determining the political action in the region have caused the emergence of many voices, but those voices and point of views still need to be taken into account. Considering these new voices means not only supporting public/private partnership perspective, in which people could play only a marginal role in a simple listening top down approach (even if this may be considered a starting point towards more democratic practices of planning) but, above all, allowing local communities to participate in the policy making processes thus restructuring problems and changing the rationality of decision making. If we begin to think to planning practices from this point of view multiple realities come to the forefront and emerge as fragments of complex interactions among different processes and ways of knowing as well as of thinking about possible development paths in the park.

Women perceptions and actions concerning the environment are one of this fragments. A gender perspective, usually dismissed in the local consolidated policy-making process ruled by technical-scientific rationality (Sandercock, 1998), is a way of exploring the issue of local knowledge in the Alta Murgia. Gender-specific division of labour, property rights, decision-making processes and perceptions of the environment all shape local knowledge, use and management of the environment (Gregoire and Lebner, 2002).

Have women ever played a role in shaping the Alta Murgia? What local transformation practices still alive, or how have they been changing? In which ways could a gender point of view contribute to preserve the environment and local sustainable economies? How can a gender perspective help to enact or sustain learning and innovation processes in the region? Issues of gender, environment and development are interrelated and constantly shaped and re-shaped by discourses and therefore cannot be addressed independently.

Before considering local, women knowledge acquisition and structuring problems faced in this research, it is necessary to explain the point of view assumed on local knowledge. Different and contradictory perspectives exist about local knowledge. It is assumed that local knowledge is ordinary knowledge defined as an evolving conversation (Fischer, 2000), a body of knowledge built by a group of people through generations living in close contact with a specific socio-environment. "It includes a system of classification, a set of empirical observations about the local environment, and a system of self-management that governs resource use" (Johnson, 1992). Moreover studies carried out in this field show how local knowledge is socially-differentiated according to gender, age, occupation, socio-economic status, religion, and other factors. If it could be inappropriate to generalise about local knowledge, it could be equally wrong consider local knowledge as it were independent from global processes. These last play a relevant role in reshaping local human/environment relations. In a network society local knowledge cannot be detached from global processes with which it interacts.

A mental model reflects the beliefs that an individual has about a certain domain, situation, or task. But it is useful also to consider cognitive social process (Massey, et al. 1997; Eden and al. 2001). Thus cognitive mapping has been chosen in order to explore local/women knowledge.

A Cognitive map/filter allows the world of experience, worldview, culture and knowledge to be explored (Kitchin and Freundschuh, 2000). It highlights the concepts or factors that participants consider relevant to a particular issue and provides an indication of the perceived relationships among these factors (Kearney and Bradley, 1998). It is a way to privilege adaptive and learning processes enabling individuals and groups to identify aspects that are significant for environmental planning and management. These cognitive filters help to highlight the tension between different knowledge systems thus furnishing one of the relevant dynamic of cultural evolution and social change (Banuri, 1990). "An ethnographic description of a group and its worldview must tap the cognitive world of the individuals concerned. It must identify the different category systems individuals use and it must discover those features of objects and events that are regarded as significant for defining concepts, formulating proposals and making decisions" (Studley, 1998).

Moreover, there is a problem that cannot be discarded in trying to represent and make this knowledge usable: the risk of treating it as if it were possible to utilise it "out" of the context in which it has flourished and to consider it as an economic resource. The risk is to consider it relevant and valuable when used and processed in ISs (Information Systems) in any context.

## 2 FACING LAY KNOWLEDGE REPRESENTATION TASK IN ITS ENVIRONMENT

Dealing with lay knowledge within ISs requires a distinction between two possible representation goals: structuring and implementational (Bingi et al., 1995). Obviously the representation of knowledge in an IS can have also both the perspectives but for the following discussion we keep them separate.

A preliminary consideration refers to the specific need for knowledge representation: IS' users can be limited to knowledge retrieval and/or knowledge base completion thus making the structuring task mostly relevant; differently, knowledge use can be oriented to its computing and production abilities therefore keeping knowledge engineers' attention on the implementational perspectives.

In the first case large and easy accessibility to the knowledge base is required and the accessibility issues include the need for high communicability of cognitive structures and contents in order to enable knowledge sharing and transfer among different cognitive subjects.

When dealing with lay knowledge and, possibly, with lay system's users, differences in accessibility, comprehension and analytical skills have to be considered when implementing knowledge bases in IS. Both expert and lay people have to be

guaranteed for knowledge access and transfer: traditionally, knowledge representation structures have been developed within expert environments thus mainly being far from structures eventually already recognised or owned by lay people.

This problem becomes more evident when the basic goal for knowledge representation within a structuring perspective is the active access to the knowledge base, that is the possibility to access and modify it by adding new knowledge, by changing some portions of the knowledge base, by assessing it. Referring to modification opportunities, knowledge base accessibility becomes a relevant issue and requires it to be planned within the system taking into account the need for simplicity without losing in efficacy or becoming trivial.

In the second case, the implementational perspective makes the lay knowledge representation face, in a deep sense, the problem of knowledge fragmentation, which is typical of lay knowledge. For implementational purposes, knowledge representation traditionally requires lack of ambiguity, clarity, uniformity, notational convenience, relevance and declarativeness. All these requirements are already difficult to be satisfied when dealing with expert knowledge and becomes quite impossible to be addressed in the case of lay knowledge. This last is fragmented, always contradictory, almost never complete, not uniform in many different senses, and is deeply instable. When considering all these aspects, the possibility of exploring an implementational perspective is deeply challenging but not yet largely investigated.

Fragmentation of knowledge, and even of information, has been investigated in a representational perspective mainly in relation with expert knowledge (Tanaka et al., 1995; Lyn, 1996; Cairo, 1998) and with its integration or synthesis within an implementational approaches where the cognitive integration/synthesis goal largely refers to the need for solution searching and finding. Differently from expert knowledge, fragmentation represents an intrinsic property of lay knowledge and an integration/synthesis attempt may be deeply incorrect: a representation which integrates or synthesizes knowledge may conflict with the knowledge contents themselves. Fragmentation, when referring to lay knowledge can be considered not a problem but, conversely, a possible framework to refer to when developing the knowledge representation model. Integration does not represent, dealing with lay knowledge, a goal to achieve in the representation unless it becomes a particular condition to be explicated.

### 3 CHANGES IN INFORMATION SYSTEMS

One of the fundamental shifts in information systems is considered the increasing commitment in sharing information/knowledge and integrating formal knowledge and informal knowledge and its related meaning in order to sustain learning processes in complex and competing organisations. Knowledge management assumes a strategic role in a competitive economy even if the relations between information and communication technology and knowledge is problematic (Hendriks, 2001). Thus,

common sense, fragmented and different knowledge sources, and different languages begin to be crucial in constructing shared and effective knowledge bases to support virtual or situated team work. But informal, tacit knowledge is difficult to represent, since it is constituted of a set of narratives, values and practices which experts-scientists have to tackle in the heterogeneous processes and this prevents structuring and aggregating knowledge and information outside a specific context of action. Including tacit and informal knowledge in information systems leads to hybrid systems where different information/knowledge sources are structured at different levels depending on the source itself.

In the public sphere lay knowledge parallels the informal knowledge in organizations. In environmental planning keeping different points of view together and sustaining diversity rather than propose a unique information frame represents a path towards creativity. This is a strategic option in regions and institutions which need to learn either to compete in market economies or to plan and manage local environment in sustainable ways in a perspective of globalisation from below. Sharing and integrating different knowledges is a crucial step in every process aiming at innovating and changing local microworlds of consolidated practices and cognitive routines (Maciocco, 1999). Sharing and integrating represent two complementary aspects of communication: the former is necessary to connect a fragmented world, even if not ever by shared visions, while the latter is rooted in a transformative approach based on social learning.

What can be said about information systems and geographical information systems in environmental planning where decisional environments are plural and distributed and interactions among actors are both situated and virtual? What role could geographic information science play in this changing frame of reference on information systems? The role of GIS has been reconsidered in relation to communication and participation requirements emerging from new perspectives on urban and environmental planning and management. In changing social-economic contexts the problem in constructing GIS is twofold: on the one hand it is necessary to face the spatial fuzzy dimension of local knowledge and on the other to understand the process through which this knowledge and information, seen as the output of a local/global, complex and evolving conversation, is shared and integrated. Both require rethinking the information systems themselves starting from the process of knowledge acquisition and construction of knowledge bases up to the way in which information and knowledge are processed. This is not only a problem of representation: the problem is to face the gap between theory and practice, between the formal theory of map and actually implementable systems (Aiello, 2001). What are the missing links between the map and mental models of geographical space owned by individuals or groups? Trying to represent local, informal, tacit knowledge poses problems about this gap.

These issues have highlighted the need of a shift from the information space to that of information and knowledge and their related meaning. This means recognising, on the one hand, that information is a result of complex cognitive processes and on

the other that the space of information is constituted by both geo-datasets and virtual relations among people.

Sharing of information has assumed a relevant role not only as regards information requirements emerging in local planning environments, but also in relation to the need to overcome the gap between traditional geographical representations and the mental models of the geographical world in local communities (Harris and Weiner, 1998). Moreover, in multiagent decisional environments of planning, sharing and integrating different kinds and sources of knowledge constitutes also a way to overcome the conflict implicit in distributed forms of communications: the conflict between embedded and mobile knowledge (Kanfer et al., 2000), i.e. between a local situated cognitive process and a distributed one which presuppose the possibility to transfer knowledge out of the context where it has been produced. The point at stake is the transfer of procedural rather than substantive rationality.

An answer to these challenges is, on the one hand, the ontology driven GIS (ODGIS) mainly thought as way of sharing information, and, on the other GIS integrated in cooperative systems: the need for knowledge integration in planning outlines the necessity for support system able to favour argumentation and mediation among different points of view to dynamically construct shared abstractions suitable to a specific context of planning.

In the first case the focus on effective ways to represent geographical information does not imply the exploration of the way in which this representation has been changing in a interconnected plural environment. In the second case the attention is on the way in which individuals or groups involved in a problem setting task interact and change their worldview. The focus is on effective systems architectures and on effective cognitive model. "In OGDIGIS ontology is a logical theory accounting for the intended meaning of a formal vocabulary, i.e. its ontological commitment to a particular conceptualization. Ontology is an essential part of GIS since it allows the establishment of correspondence and interpretation among different domain of spatial entities and relations" (Foseca et al., 2000). In this perspective the role played by knowledge engineering is important because of the need to translate the intentionality perspective in a format which can be implemented and understandable by the end user. Ontology represents a higher level of language in order to hold geospatial information communities together. Further studies outline how geographical entities are continuously being transformed and new ones created. This implies to enlarging the concept of ontology and including it in that of "action-driven ontologies" which refer to knowledge discovery processes while it takes into account the dynamic character of the production of geographical space. Action-driven ontologies should represent, stressing the intentionality dimension, an unified data model able to overcome the field-object dichotomy (Câmara, 2000) .

Even if this approach may help to connect geospatial communities and to share data and it may appear useful in order to make knowledge domains explicit as well as to reuse knowledge, it has been criticised for the assumptions at the base of this new data model. These assumptions seems to be abstract like those used in the classical

object field model and based on unclear judgments (Curry, 2000). Thus knowledge structure is again pre-planned and in so doing it orientates towards a specific vision of the world. The process of building or engineering ontologies for use in information systems remains an arcane and must become a rigorous engineering discipline (Guarino, 2002).

The perspective in which GIS is a module of a cooperative system is different because the focus is on actors interactions and on modular problem setting or solving. This is the perspective assumed here, that of the construction of a multiagent systems in which conceptual mapping should be seen only a first step towards a collaborative GIS which allows lay knowledge to be reused without processing it. Moreover conceptual mapping constitutes a necessary step in order to move towards multiagent systems in which intentionality and conceptualisation merge, and are being used in a descriptive way in order to reflect on communication protocols and at the same time on spatial representation. Communication protocols are one of possible paths exploring how lay knowledge interacts and what kind of cognitive changes occur in these interactions. The focus and the purpose of the system, in this approach, is the collective construction of shared meaning as a base for planning and managing the environment bottom-up.

Cognitive maps are a sort of interface through which people can make their frame explicit and clarify the meaning of the whole geographic representation, even though that representation (cognitive and geographical) is still a product of a technical- scientific rationality. These representations are not a means for justifying, they are the base for negotiating different discourses on local development in order to change them and produce shared action framework.

Since cognitive maps are one of the possible ways to make knowledge explicit, allowing lay people to construct shared meaning implies giving them access to other sources of information which could help to clarify the meaning of concepts when they are used in virtual space of interaction. For this purpose cognitive maps have been designed as one of the possible sources of information to share on the web. These sources are “heterogeneous” on many levels. The underlying concepts may differ in subtle ways and one simple concept may be represented in different ways by many different information sources. For this reason this research is a first step towards finding effective ways to deal with problems of heterogeneous information integration.

#### 4 STRUCTURING LAY KNOWLEDGE: WOMEN AND LOCAL WORLDS IN RUVO DI PUGLIA, ALTA MURZIA

The context is a medium-size town, Ruvo di Puglia, in Alta Murgia, which is a large rural area where a national park is being set up. Since the communities play a crucial role in this process, the representation of lay knowledge can improve the dialogue between the different actors involved in it. The interaction of different “knowledges”

in plural decisional arenas is considered one of the basic conditions to face effectively environmental conflicts and to design a shared future. Because the representation of informal knowledge is not yet a well-defined domain, the first step is to define methods for acquiring and structuring it. In the case at hand, knowledge structuring was articulated in three phases: acquisition, analysis and GIS construction. The knowledge was acquired from a specific part of the local community: the women who live on the farms situated in the rural area of Ruvo and involved in the setting up process of the Alta Murgia national park. The decision to adopt a gender perspective meant to rediscover their role in the informal economies of the area and to enhance the features which point to a sustainable future. In fact a sustainable perspective requires protection of the wealth of socio-environmental values embedded in the area. Knowledge acquisition implied the construction of two series of open and semi-structured interviews in order to allow the women interviewed to express themselves freely, i.e. using their own frames of reference rather than predefined sets of categories.

The aim of the first series of interviews was to disclose the descriptions of Alta Murgia through stories as told by these cognitive agents. In particular the aim was to look at these descriptions through listening to narratives regarding, on the one hand, the local ways of recognising and localising places, and, on the other, the practices of use and transformation of the local resources. The second cycle of interviews was planned to attain two goals: validation of the methods used to interpret the knowledge acquired and a more in-depth exploration of specific issues which appeared to be relevant. The identification of places and the meaning attributed to them were two of these issues.

The second phase concerned the verbal protocol decoding. The aim of the analysis of the narratives was to identify complex descriptors able to grasp concepts embedded in them and to allow the knowledge acquired to be classified. Recurring parameters used in narratives, such as localisation, transformation of the local environment, judgments, meaningful places, helped to identify these descriptors. Further investigations regarded the identification of different typologies of places in relation to the functions and visions people attributed/associated to them. This required sketching the relationships between the meanings associated to those places and the criteria utilised by women in recognising local resources (wilderness, rarity, specificity, vulnerability, affectivity, use, capacity of production).

The third phase consisted in constructing the GIS. The goal was to find ways to overcome the constraints posed by the GIS itself, such as the traditional geometric frame imposed by maps which meant “reducing” the complexity of narratives when translated into geographical information. In fact the vision on geographical space, which, emerged in this case of study, contradicted the traditional objective interpretation of the world with the wealth of perceived worlds, full of experience and contradictions, described by each cognitive agent in his/her storytelling. Information can no longer be interpreted as an object, it should rather be seen as an expression of a relation between sign and intentionality owned by the subject (Couclelis, 1999) who

is concerned with it and functional to the purpose with which the information process is triggered.

Cognitive mapping offers an approach which is able to deal with the relation between sign and intentionality. It is an approach which makes it possible to explicit the frame underlying the multiple visions of local agents, to navigate among different cognitive paths and, if necessary, to explore them more in depth. For this reason cognitive maps, both those representing a shared vision on a specific problem and those describing individual cognitive frames, have been associated to maps drawn on the basis of the interviews utilising an hyper textual structure. As far as possible the structure of the database has been designed following the cognitive paths sketched in the cognitive maps and with reference to criteria and descriptors utilised by local actors. Thus the database structure is functional to the representation of places, criteria and descriptors emerging from the analysis of the interviews.

The constructed GIS gives effective and articulated information on Alta Murgia. A relevant role is assigned to local/territorial socio-economic dynamic processes. When these processes are interpreted at the local scale - the farm- they are related to conflicts and problems characterising local planning practices and to global policies with particular reference to EU policies. At the territorial level, social economic dynamics are mainly perceived and described as environmental degradation and change. This vision can be considered consensual if referred to environmental damage produced by mining activities and to the increasing risk of arsons attacks during the summer. It reveals conflictual values when related to the recent agricultural practices boosted by global policies. Thus, the necessary evolution of the agricultural activities which is often caused by the need to increase/sustain the productivity of the farms in a market economy rather than from the need to protect the environment, is in itself an agent of environmental transformation. These transformations are carried out daily by practices and the design of projects and programs.

The values of places emerge in their reciprocal relationship with the process of identification of local resources even when they are non sustainable. Moreover environmental risks and land use conflicts are represented as perceived from a gender perspective. Local knowledge is “spatially fuzzy” (Weiner et al., 1996) and uncertain and dependent on the context where relevant environmental problems and difficulties in identifying local resources and formulating environmental policies exist

Thus the representation of the local context requires data, but information on local behaviour obtainable from spatial perception mental models of local community are not less relevant. In order to represent contextual information as described above the quality of lay knowledge have been considered: in particular its practical orientation, its multilevel perspective – even if details abound in the description on the small scale -and its ability to integrate long range vision with those needed to manage short period changes. Because lay knowledge is continuously restructured its representation should be able to show the evolving character of these knowledge bases and should be evaluated by appropriate procedure in order to avoid information redundancy.

## 5 PROBLEMS AND PERSPECTIVES EMERGING FROM THE CASE STUDY

On this study there emerges the relevance of the process of the construction of a GIS based on the exploration of lay peoples' knowledge base because of its individual, social and cultural meaning. The process of knowledge acquisition and structuring makes it possible to define the structure and the organization of information in effective and user-friendly ways; at the same time it makes it possible to look for both other ways to represent geographical information and for further representational tools able to represent cognitive paths underlying the information itself.

The strength of a such structured system is in the acknowledged role that cognitive mapping could assume if associated to spatial modelling. Cognitive mapping is a means to deal with complexity and an attempt to reduce the distances between the conceptual dimension of lay knowledge and its representation in a geographic space.

The role of cognitive mapping considered in relation to the idea of usable knowledge makes frames and visions of different agents clear. It gives a way of navigating through relations and meanings rather than through an exclusively geometric and/or modelled space. Moreover, even if limited, it allows people to compare different geographical information worlds, and to consider the information itself not as given but as constructed, as a result of an ongoing process.

Many problems have to be faced using this approach. The separation between cognitive and spatial models can be only partially resolved in a GIS environment which does not allow relations to be managed between geographic and cognitive maps, between concepts and spaces. In this environment cognitive maps represent a sort of information meta-level which enhances more in-depth exploration of different geographic worlds and allows users to recognise, dispute or modify meanings attached to it. Thus spatial representational tools need to be restructured in order to take into account the emerging need to manage informal knowledge, a challenge, this latter, consisting in trying to represent non metrical, relative spaces (Couclelis, 1999) and in suggesting different approaches in social science. An isotropic space of representation does not allow geo-referenced places to be reconnected with problems and behaviours and with the value and meaning of places themselves. Irresolvable problems emerge in a GIS environment concerning the need to represent a place with a particular meaning in the collective imagination compared to another place undervalued by local actors.

Managing uncertain, ambiguous information and spatial vagueness means considering in a new perspective terms such as error or accuracy. In fact to define the spatial reference system used by the women interviewed was a complex task because of the multilevel structure they used in describing processes and places. In particular how to localise and define the dimension of different spatial processes was an unclear task since it needed to be compared to the personal perception which is linked to the area of action/influence of a single agent. Moreover the stratification of meanings attached to certain places by communities and typical of lay knowledge is not

manageable in a spatial system tool constructed to represent single places with their related attributes following the technical scientific place-based model (Pickles, 1999). The mono-logic and objective spatial model embedded in GIS is not fit to represent and store different points of view and ways of knowing in geographic information. Obviously there is a shift of focus in constructing GIS from typical problems such as precision, accuracy and reliability towards a reconceptualization of “data quality” requiring new attentions on processes and methods for acquiring and interpreting local knowledge. This case study, as a first step in this research, gives some direction towards the identification of these methods even if further research is needed in order to solve problems of informal knowledge representation and of the relation between cognitive and spatial modelling. At the same time a validation process must be carried out, on the one hand, to test interpretative methods of lay knowledge and, on the other, to allow local actors to interact directly with the systems and to promote learning processes while communities use the system itself.

The environmental planning contexts considered in this study is a deliberative multiagent environment in which distributed informative bases interact. The interactions are both between different points of view in local knowledge and between expert and common knowledge. For this reason the structuring process needs to be evaluated in relation to these interactions. The purpose is to try to define new datamodels different from the relational and object oriented ones and thinkable as metamodels (Alexiou and Zamenopoulos, 2001) able to manage and integrate the most suitable model to the available information.

## 6 CONCLUSIONS

This paper faces some of the basic questions linked to lay knowledge representation. This last can best be understood in terms of roles that a representation plays in plural context of planning which posing different and at the same times conflicting demands on the properties a representation should have.

The case study also enabled some considerations in terms of knowledge acquisition procedures. Traditionally, the knowledge acquisition activity is carried out by the knowledge engineer who is the knowledge catcher and the knowledge translator in to structures being implementable into Information Systems environment. For both the perspectives, structuring and implementational, the lay knowledge acquisition procedures becomes more crucial. The knowledge acquisition procedure can be different depending on the kind of representation and the role of the knowledge engineer can change as well.

Due to the need for easy and large knowledge access, in fact, to the eventual need for an easy introduction of modifications, and to the need to keep the cognitive fragmentation framework within the knowledge base structure, the knowledge acquisition procedure should reduce as much as possible the interpretational role of the knowledge engineer. The acquisition procedure should be mainly direct between

the knowledge sources and the system thus giving the opportunity to the users to gain confidence in the system representation framework.

Dealing with lay knowledge, therefore, asks for acquisition procedures being largely automatic and representing parts of the system itself: the users/knowledge-sources should be able to select a high confidence representation framework and work on it transforming the acquisition process into a selfreflexive structuring and representation process.

## 7 NOTES

This paper is the result of the authors' team work; their individual contributions are as follows: sections 4 and 5 by G. Caratù; section 2 and 6 by G. Concilio; sections 1 and 3 by V. Monno.

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