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A Process Memory Platform to Support Participatory Planning and Deliberation

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"...if we did this together we can do everything amore…"

Anna De Liddo

August 29th

Milton Keynes, UK

for Giulio De Liddo
my grandfather

Abstract

The communicative turn in planning theory argues that knowledge in planning is a social construction, emphasizing that knowledge is built in social contexts, by a plurality of actors, through their interactions. This new understanding of knowledge is built around the need of plurality of reasons and voices to inform and legitimate planning actions.

However this knowledge is often difficult to capture and integrate within the wider knowledge base that planners generate in the planning process. The body of knowledge guiding and supporting the planning process is captured in distributed fragments that come from a combination of present and past information, facts, people and artefacts produced by dispersed decision-processes. This knowledge fragmentation and distribution hampers, and often impedes, transparent and coherent decision-making processes in participatory planning practices.

The thesis addresses the challenge of transparent knowledge integration, focusing on the definition of new methods and tools to handle and integrate planning knowledge in order to trace how design decisions develop to create a planning process memory.

An information architecture is proposed to represent and manage participatory planning knowledge, and a multimedia tools platform has been designed to represent how knowledge evolves within this software environment.

This work is evaluated through multiple, real planning case studies, in order to test both the methodological aspects (application of the information architecture for knowledge acquisition and representation) and the tools (Compendium, CoPe_it! and FM).

Evidence is given of how the information architecture coupled with the use of a hypermedia visual Knowledge Management System (hvKMS) (Compendium) offers a valuable support to managing knowledge in Participatory Planning. In particular the information architecture enables effective representation of knowledge fragments in different dimensions according to their relevance to different contexts. This implies two grades of benefits: i. discovering knowledge connections and impacts across contexts; ii. having a thematic but holistic view and understanding of the process memory.

Furthermore, the case studies show that the tools are easy to use, flexible and customizable. Several examples are given of how the tools can support the tracing and representation of planning processes which differentiate for method, task, scale, planning phase and stakeholders involved.

As a final result of the platform and method testing, the thesis discuss three facets of a process-memory platform for planning practices at the technical, political and community levels. A critical analysis of the results is presented regarding limitations of the platform and, starting from this consideration future work and system evolution will be envisioned, recalibrating objective and strategy to new research challenges.

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1 Introduction

Participatory Planning is a collaborative governance practice in which different people and organizations, at different organizational levels interact and deliberate about planning actions and scenarios for the future of social commons and spaces. The character of planning problems and the impact of planning actions on social life of communities make this practices particularly complex and demanding for new methods and technologies to support this process at different levels.

Participatory Planning studies base on the stance that enlarging participation and involving inhabitants in the planning process helps creating environments that better responds to the practical needs of the population and that better represent its cultural and emotional desires and attitudes (Sandercock '98; Forester '99; Campbell and Marshall '00; Hillier '00; Innes and Booher '04). Nonetheless contrasting proofs are given on the argument that design performances can be effectively augmented by the contribution and involvement of a broader set of people and knowledge bases to the design process(Hanna '00; Umemoto '01; Mostert '03). We identify the main reason of failure in some participatory planning activities in the lack of methods and tools to manage and represent information and knowledge acquired in these processes, in a way that allow this information and knowledge to be operatively reused in the design process.

The approach chosen in the thesis is an engineering approach to Participatory Planning oriented to the study of new ICTs to empower new voices in the planning process, by augmenting the impact of these voices in the real design practice. Our main objective is to allow different voices to concretely inform and influence the design process rather then to enlarge participation to enhance democracy in the political meaning of the term. That's why the focus is not on number of people to be involved but on claims this people makes, on information and knowledge that can be gathered from these claims and on the role this knowledge can play during the process.

This approach can help planners to defend and explain design decisions and at the same time it is a way to share risk and responsibilities of the challenging and complex practice that is planning for the future of common spaces and resources.

We conceive Participatory Planning as an *organizational* practice of *participatory design*. The organizational dimension put the accent on the importance to recognize stakeholders in their organizational endeavour; while the participatory design dimension stresses the concept that planning is a collaborative process of making design-decisions.

This process is a process of dialogue and deliberation in which different stakeholders and experts are engaged in expressing ideas about specific issues and alternative design solutions while exploring and making design decisions. We refer to communicative planning theory looking at this theory from a new organizational and knowledge oriented approach (Dant and Francis '98; Innes and Booher '08). In the thesis we seek to acquaint robust and defensible positions on the key issue of managing and integrating knowledge in participatory planning. We explore methods and tools for knowledge management, knowledge representation and

knowledge exchange in order to achieve better-informed and transparent participatory planning processes.

1.1 Research Questions

The research presented in this thesis is motivated by the desire to improve participation in urban and environmental planning. We approach this by addressing the particular challenge of making more transparent how stakeholders' contributions in public consultations are captured in, and recovered from, the project's collective memory, in such a way that there is a trace left showing how contributions informed decision making. In particular, we take as central to participatory consultation the processes of dialogue: participatory knowledge construction must be generated through meaningful deliberation between stakeholders.

This is an ambitious challenge, confronting the complexities of information and knowledge management, public accountability, and capturing argumentation around socially/politically charged topics. The thesis is built upon the hypothesis that used appropriately, a Participatory Process Memory software platform can help to address the above requirements.

Thus, the central question the thesis addresses can be summarised as:

Can a process memory platform enable better knowledge management and transparent knowledge integration in participatory planning?

This question is elaborated as a set of more focused Research Questions, tackled in the forthcoming chapters as follows:

- RQ1: What is the role of process memory in enabling participatory planning? (Chapter 4)
- RQ2: What are the functional requirements for a process memory software platform? (Chapter 5 and 6)
- RQ3: How can ICT tools be integrated to capture, structure and represent planning process memory? (Chapter 6)
- RQ4: Which methods are appropriate for participatory knowledge acquisition, representation and management? (Chapters 7-8 and 9)
- RQ5: Is the participatory process memory platform effective? (Chapter 10)
- RQ6: What potential and risks does the memory platform hold for participatory planning? (Chapter 10)
- RQ7: What requirements should define the next design iteration of the memory platform? (Chapter 11)

In addressing these questions, the thesis motivates the design rationale for a multimedia 'Process memory' platform, implemented and evaluated through a series of participatory planning case studies.

1.2 Approach

Planning is undeniably a cognitive task, which has been investigated experimentally within the cognitive science paradigm using controlled experimental conditions for hypothesis testing (Simon '69; Simon '77). It is certainly one of our objectives to provide cognitive support for individuals and groups in focusing attention, navigating complex information spaces, and retrieving information. However, planning is self-evidently also a socially, culturally embedded practice involving individuals and organisations negotiating definitions and decisions under technical and other constraints. Moreover, this is a design research project, in which the challenge is to analyse the requirements for a novel artefact, building as far as possible on known principles, plus evidence from existing tools, in order to then deploy and rapidly iterate the design in response to a range of authentic planning case studies.

In this sense we follow the reflective design practice that Schön (Schon '83) defined as 'reflection-in- and on-action'. The 'research story' is told with continuous effort to remain faithful to the social complexity of the case studies, while looking for models and tools to help the researcher to deal with this complexity. As in soft system methodology (Checkland '98; Checkland and Poulter '06), observation is followed by a first modelling attempt, which is then refined in response to feedback in a continuous learning spiral that does not presume to terminate with this thesis.

1.3 Thesis Contributions and Chapters' Outline

The thesis makes the following contributions, as answers to the Research Questions:

1. A sensemaking approach to participatory planning is motivated, focusing on how knowledge is built through planning conversations.
2. An information architecture and an annotation taxonomy have been designed to promote the flexible, transparent indexing of knowledge fragments in participatory planning deliberations.
3. A range of multimedia technologies is analysed for their suitability to capture and manage such discourse-centric planning knowledge.
4. A software tool embodies the above contributions as a prototype process memory platform capable of integrating the results of face-to-face/virtual, synchronous/asynchronous, in situ/at-distance discourse.
5. Evaluation data from six planning case studies illuminate the potential and limitations of the prototype, motivating requirements for future design iterations.

The thesis is divided into three parts.

Part I comprises Chapters 2-4, and is devoted to presenting and analysing the research context and motivating the Research Questions.

In Chapter 2 we motivate a view of participatory planning as a collaborative sensemaking process performed through interaction and deliberation between participants. We argue that conducting, and analyzing, planning design deliberation in this way enables a process of 'knowing' about the social and organizational context in which the design develops. Moreover this sensemaking

process shapes the design knowledge base the group generate through interaction and communication in the participatory design practice. Finally we discuss the implications of choosing this conversational metaphor for participatory planning practices and we discuss a new approach to participatory planning which aims at addressing ambiguity problems through transparency seeking.

In Chapter 3, the character and role of knowledge in participatory planning is described, discussing the challenges to knowledge capture, integration and management in planning processes. Knowledge in planning is described as extensive, and distributed along time, space, process tasks, stakeholders; and it is described as constructed through social interaction and planning conversation. To tackle the challenge of acquiring, tracing and representing such knowledge, a knowledge objects taxonomy is proposed to support information and knowledge representation on multiple contexts. The challenge is contextualized to the e-participation domain and new ICTs supporting participatory planning.

In Chapter 4 we address RQ1 and discuss the research motivation, explaining why and how a process memory platform can support participatory planning. From the literature review on organizational memory and argumentation theory we motivate and introduce an applied theory of memory. Memory is referred to as process-memory or project-memory; that is an artificial memory built through capturing and mapping deliberation and argumentation within a planning practice. The process memory platform is defined as an environment to capture, structure represent and manage knowledge produced in planning conversations in order to: i. support deliberation, ii. enable sensemaking and iii. inform planning decisions with a wider and diverse knowledge base collaboratively generated.

Part II describes the memory platform and its components.

Chapter 5 discusses the cross-organizational functions that the memory platform is designed to address within a planning system. We partially address RQ2 (that will be also tackled in chapter 6) by proposing a conceptual model of process memory for participatory planning. We then address some theoretical issues related to the memory objects granularity and the key role played by the knowledge manager in the use of the memory platform.

Chapter 6 centres on the description of the process memory platform architecture and of the three tools that have been chosen as modules of the platform. In particular we address RQ2 describing the functional requirements for a process memory software platform and RQ3 providing description of the three tools selected and integrated in the process-memory platform: Compendium, FM and CoPe_it!. Compendium is a visual, hypermedia Knowledge Management tool, which has been customized and used to structure, manage and represent planning knowledge. FM is a web tool for videoconferencing and distance interaction. Whereas CoPe_it! is a web tool for enabling at distance synchronous and asynchronous collaborative argumentation. We describe the tools' features and discuss how they can be used for classifying, organizing, managing, representing, recording and exchanging knowledge in planning practices. Finally we describe design and implementation of the integration between Compendium and CoPe_it!. The integration project allows opening the memory platform to the World Wide Web by allowing on-line knowledge contribution and delivery.

Part III is centred on the application and testing of the memory platform. We present the case studies and discuss results of the evaluation of the memory platform.

Chapter 7 describes the multiple case studies approach chosen in the thesis and details the case studies framework. It comprises two evaluation studies: one to test memory building activities and another to test memory exploration activities. The case studies are grouped within these two categories. Finally they are presented and summarized in order to make sense of how the different platform features are explored by each case. This chapter together with Chapters 8 and 9 address RQ4 giving example of methods and tools for participatory knowledge acquisition, representation and management.

Chapter 8 reports the results of memory building activities in five case studies. By memory building activities we mean the activities a planner needs to perform to construct or reconstruct the process-memory: capturing, structuring and representation information and knowledge in a way that captures planning process evolution in multiple contexts. In this chapter we describe the different memory building methods adopted in each case study. We then discuss the advantages /disadvantages of those methods, and success/failure of the different applications.

Chapter 9 defines and tests an information architecture to acquire, annotate and represent information and knowledge. The information architecture is built according to the knowledge taxonomy proposed in Part I in order to operationalize and test the knowledge taxonomy in a real case study. We also describe how we used Compendium, previously described in chapter 6, to implement an information architecture and annotation scheme specifically designed for tracing deliberation in planning conversations. In particular we define a framework for information modelling: information (1) processing, (2) structuring and (3) representation of planning discourse. Finally we describe the results of the application of this framework to one of the case studies.

Chapter 10 focuses on testing the process memory platform usability thus specifically addressing RQ5. A range of research techniques is used for data collection and analysis. Following a series of lab-based information retrieval tasks with the prototype memory platform from the SPP case study, Computer Assisted Qualitative Data Analysis (CAQDA) of participant's screen movies provided insight into the prototype's ease of use and effectiveness. Questionnaires were used to test general reactions and explore possible uses of the system for different tasks and different expertise. Two semi-structured expert interviews with representatives of different organizational level (technical and political level) are also discussed. In addition an experiment with a class of planning students gathered further evidence from non-expert users. The experimentation with the students consisted of an experience of collaborative system exploration a post-exploration questionnaire. Finally quantitative techniques have been applied to analyse both the data extracted form the behavioural experimentations and the questionnaires answers. In the light of the evaluation study results answers RQ6 and discuss potential and risks hold by the memory platform.

Chapter 11 presents the final discussion and further research studies. First we discuss three facets of a process-memory platform for planning practices at the

technical, political and community levels. Moreover a critical analysis of the results is presented regarding limitations of the platform and of the evaluation study. Starting from these considerations we address RQ7 by envisioning future work and system evolution and recalibrating objective and strategy to new research challenges. The thesis concludes with the description of a next generation process memory platform. Transparency is presented as a "buffer" against the unavoidable gaps of uncertainty and complexity in planning practices.

1.4 Publications

2008

Celino, A., G. Concilio and De Liddo A. (2008). Managing Knowledge in Urban Planning: Can Memory Support Systems Help?. Knowledge Management in Action. In M. S. Ackerman, R. Dieng-Kunz, C. Simone and V. Wulf (eds), Springer. IFIP 20th edition World Computer Congress 2008, Milano.

De Liddo A. (2008). A Collaborative-Project Memory for Participatory Planning, The Association of Collegiate Schools of Planning (ACSP) and the Association of European Schools of Planning (AESOP) 2008 fourth Joint Congress, July 6 -11, Chicago, US.

Celino A. , Cuonzo, M.T. and De Liddo A. (2008). Representing Participatory Processes in Planning Programmes, The Association of Collegiate Schools of Planning (ACSP) and the Association of European Schools of Planning (AESOP) 2008 fourth Joint Congress, July 6 -11, Chicago, US.

De Liddo A. and Buckingham-Shum S. (2008). Knowledge Media Tools for Capturing Deliberation in Participatory Spatial Planning, Directions and Implications of Advanced Computing; Conference on Online Deliberation (DIAC-2008/OD2008), University of California, Berkeley, June 26 - 29, 2008

Celino A., Concilio G. and De Liddo A. (2008). Planning in Knowledge Intensive Contexts: Systems Supporting Memory Tracing. The 3th International Conference on Information & Communication Technologies: from Theory to Applications - ICTTA'08, April 7 - 11, 2008, Umayyad Palace, Damascus, Syria.

2007

De Liddo A. , Concilio G. and Buckingham Shum S. (2007). Advancing Knowledge Management and Exchange between Collaborative Environments: A Tool Integration Perspective, EC-TEL07 at the 2nd International Workshop on Building Technology Enhanced Learning solutions for Communities of Practice (TEL-CoPs), September 17, Crete, Greece.

De Liddo A. and Buckingham Shum S. (2007) Compendium as Participatory, Multimedia Project Memory, Workshop: Compendium Institute Workshop 2007, NASA Ames/Conference Center, Moffett Field, CA, May 2-3.

De Liddo, A. and Buckingham Shum, S. (2007). Capturing, Mapping and Integrating Argumentation as Project Memory in Participatory Urban Planning. Workshop on Argumentation Support Systems for eParticipation, EU-IST DEMO-net Network of Excellence, March 5, 2007, Berlin

2006

Borri D., Concilio G., Celino A., De Liddo A., (2006). Structuring Short-Term Organizational Memories by Argumentation Based Transient-Scenarios, 17th International Conference on Database and Expert Systems Applications (DEXA'06), DEXA06, pp. 166-170, University of Krakow, Poland, Sept. 2006

De Liddo A., (2006). Role of organizational memory in environmental planning processes: the problem of innovation of practices, EGOV PhD student colloquium, co-organised with the Demo-net project, a Network of Excellence within the 6th Framework Programme IST of the EC. 3rd and 4th September 2006,Krakow, Polland -Abstract catalogue- www.demo-net.org/demo/dissemination/phd-projects/catalogue-061031.pdf.

Borri D., Concilio G., Celino A., De Liddo A., (2006). Modelling Cognitive Fluxes n Low Structured Organizations: The Case of Innovation Process. Aisre: XXVII Conferenza Italiana de Scienze Regionali, http://195.128.234.47/aisre/minisito_2006/cd_aisre/Paper/Borri.pdf

Celino A., Concilio G., Cucurachi E., De Liddo A., (2006), Scenari Ambientali e Contenuti Aperti: Il Caso del Delta del Po Veneto, in course of publication in Ferdinando Trapani (eds): "Urbancost Un progetto Pilota per la Sicilia Centrale, FrancoAngeli, It.

2005

Borri D., Concilio G., Celino A., De Liddo A. (2005). Argumentative Support System in Environmental Scenario Development Computer in Urban Planning and Urban Management, CUPUM '05: Computers in Urban Planning and Urban Management, Abstracts of the 9th International Conference, London 2005 by Susan Batty, ISBN/ISSN 0-9550581-0-4, 29/6 -1/7. London, UK

I Context

2 Participatory Planning: Planning in Deliberative Arenas

In this chapter we describe planning practice as performed in a deliberative and communicative environment. The arenas of planning discourses are described as they were postulated in the eighties and how they evolved in the following decades, trying to underline constraints and challenges of a deliberative approach. From a critical analysis of the arguments in the literature we motivate the reasons of the research, explaining the knowledge oriented approach I chooses in the thesis.

2.1 Participatory Planning and the Communicative Turn in Planning Theory

The actual idea of deliberative democracy and citizen and special interests involvements in planning practices has deep roots in planning theory. It developed and evolved from one theory to another changing the emphasis given to different aspects and issues related to the problem of participation in planning practices.

Friedman argues that the first philosopher introducing the concept of 'social planning' is Auguste Compte. Compte is considered the father of sociology, the first who defined the aim of social science being to work for the improvement of the mankind and of his state of civilization (Friedmann '87). Social sciences and between them planning science should follow the roles of observation and experimentation like all classical science and, as it has a normative role to define planning solution of common interest.

The rational-comprehensive planning theory in vogue in that ages states that planners should "*rely only on facts that have a scientific basis and on the authority and duty designated to their public office position*" (Forester '87). Compt as well relies on the 'scientific planner', who has the expertise and knowledge to define a 'public interest' that is not biased from subjective and/or emotional motivations.

Among the early critics to the unbiased definition of a public interest we finds Paul Davidoff and his advocacy planning theory. In his classic article "Advocacy and Pluralism in Planning" Davidoff claims that *"determinations of what serves the public interest, in a society containing many diverse interest groups, are almost always of a highly contentious nature*" (Davidoff '73), 279). Davidoff introduce the concept of plurality of definition of values and therefore of a public interest that should aim to those values.

In this period in the name of a "public interest" historical building have been demolished to make place to new development, which often produced poor results, segregation, and which modified the existing city space and the human geography consolidated along the years.

Davidoff was the first one to claim that the planner should express and states clearly what are the values that inspire and inform his choices. He should behave like an 'advocate of his decisions'.

Davidoff claims that planning has a deep political character. Behind his scientific appearance of scientific rationality it is a social and political practice. Thereby he suggests that planner should help the political process by advocating not only the local government choices but also other issues and interests raised form local groups.

The advocacy planning theory offers several advantages: first it allows the citizen to be heard in order to gather different values and point of views on problems and alternatives; second it allows citizens to be informed about the reasons behind planning decisions.

Davidoff claims: "*Where plural planning is practiced, advocacy becomes the means of professional support for competing claims about how the community should develop*" (ibid., 282).

Davidoff model of advocacy planning is suitable for highly democratic governments and is a model based on the empowerment of marginalized groups which should be assisted by the planner to make their viewpoints part to the planning process. Davidoff sees the planning process similar to a legal proceeding in which advocates defend adversary interests, bringing to the definition of adversary politics.

As Mantysalo comments reviewing Davidoff works, "*the translation of citizens' interests to the language of planning is not unproblematic*."(Mantysalo '04)

Also Schön identifies two main obstacles to the advocacy function that the planner should play: i. the group is often suspicious and sceptic forward the expert and this bias the people attitude to contribute with genuine knowledge to the planning process. This attitude undermines the advocacy planner wish to contribute with his expert knowledge (Schon '83), 295).

In the same years Lindblom, proposes a theory to bring pluralism in public planning. Lindblom incrementalism planning theory (Lindblom '59) his method of "partisan mutual adjustments" seek for compromise and bargain of interests between different groups involved in a planning issue. He aims to seek a realistic planning theory that helps planners in practical planning works. In his famous article "the Science of Muddling Through" (Lindblom '59) he claims that comprehensive-rationalist planning is unfruitful and unrealistic because planners cannot proceed with comprehensive analysis of issues and alternatives. According to Lindblom the need to simplify and to neglect possible alternatives is inescapable when dealing with complex problems and when subjected to time and money limitation, as is always the case in real public planning practices. He inspires his work to Herbert Simon Theory of "bounded rationality" but unlike Simon he suggests that making this bias systematic is actually not only the only but the best way to face public planning and policy problems. He argue that given the understanding that it is impossible to develop the plans on comprehensive knowledge about the problem, thereby partial knowledge and uncertainty of actions path and their consequences need to be systematize by concentrating on similar alternatives, which differentiate less from the actual situation and then require a minimal time and money efforts to be realized (Lindblom 59). Lindblom theory is very practical and practice oriented. He concentrates on short-term planning and actual problems. Furthermore he argues that the store of planning experiences in which to draw on the future planning projects need to be build thought incremental steps of analysis of existing planning experiences. Finally he

seeks to broaden the knowledge base of planning by involving various interest groups into the planning process. Participation in Linblom view is needed to assure that essential interests are taken into consideration. Therefore it is a matter of reaching an agreement between conflictual positions. The ideal solution is a Pareto Optimum: that is to say a loss to none and a gain to the most.

In the early seventies Lindblom theory was a good and welcomed alternative to the failures of comprehensive-rationalist planning theory, that had drawn long term master plans that did not mach the optimistic previsions they forecasted. Among the main reasons of these failures there is the wrong and over optimistic growth prevision both of population and socio-economic factors. In the middle seventies the crisis of the oil market and the 'industrial question' provoked a slow down of the economic and population growth, thereby there were no more reason and resources to draw long-term plans. On the contrary, intelligent contingent solutions were needed to allocate the few resources in the best way and with the higher short-term result.

Nonetheless Linblom theory received hard oppositions in the following two decades. The critics concern two main issues: Firstly Lindblom theory is accused to provide opportunistic solutions, which favours strong interest groups and existing policies. This means that it favours the existing power relations and it produces conservative policies by definition.

Lindblom theory doesn't have interest in including new partisans in the decision-making process, and furthermore it doesn't really focus on quality of decision but on reaching agreement through compromise. Thereby the effect of applying a partisan mutual adjustment method is to privilege the less conflictual solution despite the quality of the solution itself.

Even if we agree with Lindblom that in any group decision each one should be ready to give-up something for the group sake, the group objective should always be to discover new approaches to problems and to try to combine plural values in new creative solutions. This objective should not be bound to be similar to the status quo aims or to the willing to find a compromise. The main luck of Lindblom theory is the little interest to enter in the "why" of diverse interests and positions. Each partisan is not interested in understanding the counterparts' interests and positions. This means that the decision-making process is not a process of building shared understandings about problems to reach wider informed and value-combining solutions. It is an economic game in which utilities are calculated and then exchanged at the margin so that none is lousing much and a few are gaining what they wanted.

As underlined by Mantysalo:

"*Incremental decisions tend to mirror the values of those already in power, the status quo. In Lindblom's theory, the partisans are powerfully motivated by self-interest and also recognize this self-interest in each other. Therefore, according to Lindblom, they try to search for everyone's advantage or for no-one's disadvantage-"everyone" meaning those who are included as partisans. Mutual focuses on self-interest among the "insiders" means also no interest in bringing in new partisans to the decision-making process*."

Forester criticizes Lindblom incrementalism theory being too less concerned about the political dimension of planning issues. He distinguishes main characters of planning issues: uncertainty and ambiguity. Uncertainty is the condition of lack of information, time and resources that impede a rational comprehensive analysis to be driven and rational planning work to be performed. Ambiguity is the condition of fuzzy context of positions, arguments and objectives which define the contours of the political issues to address. Whereas uncertainty deals with technical problems ambiguity deals with political issues and legitimacy concerns. According to Forrester Lindblom theory risk to depoliticize and to unlade planning activities of their responsibility matters which concern the legitimacy of the ends and means of planning (see Forrester in Mantysalo 2000). Forester claims that problem of justification of planning choices is a matter of ambiguity and it regards the political dimension of planning and the ethical and political choices behind planning actions. He claims that Advocacy Planning and Partisan Mutual adjustment theory are technical theories of planning and therefore are inadequate to face ambiguity problems. Advocacy planning and Partisan Mutual Adjustment theories both sought to bring pluralism and consider different values in public sector planning.

Most of the critics to Dafidoff's advocacy planning theory pertain to the similitude he makes between planning process and legal proceeding. Davidoff conceive planning as a game of adversary parts that try to defend personal viewpoints as in a legal struggle. As underlined by Mantysalo "*the promise of pluralistic planning with alternative planning approaches and proposals is easily turned into unproductive adversary politics*" (Mäntysalo '04). Whereas the aims to bring different point of view and values within the planning discussion is promising the approach and method to manage alterative planning options could convert divergent position in adversary politics. Another critic moved to Advocacy Planning Theory concerns the role of planner as the 'translator' of community will in technical planning language. This role inevitably implies problems of: i. legitimacy of interpretation of group's interests from the planner; ii. trust gaining from the interest groups so that they wish to use the planner's expertise. Schon argue that transforming group's needs into the technical language of expertise is difficult because groups have an adversarial stance against the planner (Schon '83). This adversarial stance should be overcome in order to start a real dialogue between the parties. So that group's interests and needs are communicated to the planner and he can 'translate' them into technical language. Even considering that this trust barrier could be overcome the power and responsibility entrusted to the planner is very high. The space for manipulation and autonomy abuse is even more dangerous because the planner can base and legitimate his role on the sake of citizen empowerment. As underlined by Mantysalo

"*Expertise is intended to be used in the service of political empowerment of the weak citizen group, but, paradoxically, the use of expertise becomes the empowerment of expertise itself*" (Mäntysalo '00), 213)

Nonetheless Davidoff's theory makes the important point to claim for making explicit planning options, planning responsibilities of selecting between options and planning impacts on social policy. Davidoff claims the deep political character of planning. He claims that planning actions bear political matters and impacts, thereby planners should make clear, and declare the values that inform their

choices. Actually he push this concept further, and he claims that the planner "*should be an advocate of what he deems proper*"(Davidoff 1973). Even considering the negative implications that an advocacy conception of planning can have, Davidoff puts a new light on planners' personal responsibility when performing their 'technical profession', disclosing the effects that this professional practice can exert on political matters.

2.2 Communicative Planning: Planning as Sensemaking

Unlike Lindblom's theory that aims at reaching agreement through bargains of personal utilities the approach chosen in the thesis is close to Communicative Planning theory. This theory bases on Habermas's communicative rationality which consists of checking people claims against a reference of shared understanding. Habermas model of communicative arena is actually a utopian model in which all participants know and share communication rules and objectives, and have access to the same exhaustive information. This conditions are not realistic in a genuine deliberative arena where information and power are non-homogeneously distributed, rules are unknown or misunderstood, and objectives are often hidden and adversary. Thereby Habermas point of departure is actually the arrival point to which planning as communicative process aims. Our approach is based on Forrester's metaphor of design as "*making sense together in practical conversation*". Forester claims that planning as sensemaking aims at building mutual understanding through a process of design deliberation involving diverse expertise, organizations, interests groups and enlarged community members.

In this approach participation and citizen involvement process should not convert in a 'translation' of community knowledge in technical language, nor it should be an attempt to devolve planning tasks and responsibilities to the community level. Participation is part of the design process conceived as "sensemaking" process, an interpretative process of problem definition and setting other then problem-solving, a process of making sense together in practical conversation. These conversations are highly bounded by organizational, political and cultural matters and are practical in the sense of being compelled by contingent issues and case oriented topics.

During these conversations, participants make sense and interpret planning problems and discuss planning solutions

We chose a situated, conversational metaphor for design practices as formulated by Forester in his article 'Designing: Making Sense Together in Practical Conversations'. Forester suggests an alternative metaphor for design to the 'search' metaphor proposed by Simon in his book 'The science of Artificial'. Simon approach aims at abstracting design processes and modelling them as cognitive processes of 'search' between predefined alternatives (Simon '69). Simon's AI approach aims at structuring and making explicit the logical rationality of a planning process as activity of 'search' within a solution space of predefined alternatives. A clear definition of solution space parameters and method for the identification and evaluation of the best solution path is needed. In a real public planning case this two base activities can be highly problematic. In community

planning meetings it is hard to define solution space parameters. Indeed, different participants can be concerned with different issues: planners can be more concerned about aesthetic or functional matters, while community members can be concerned with security, leisure or cultural problems. Besides this, an issue can have different and novel implications in different contexts which can be measured with specific parameters. Predefining these parameters can be problematic because the contexts that are relevant in a contingent situation can vary with several factors. Some of this factors are 'system defined' like person involved, objectives, problem at stake, time in the process etc, other are actually less stable and 'interaction defined'. We refer to those aspects that are a by-product of the community meetings conversations and discussions such as new ideas, new perspective on problems, new emphasis on issues and resources, any modifications of personal and collective objectives, beliefs, purposes and any modifications of priorities both in the planning and personal agenda that participants presumed to pursue. All these are examples of possible results of conversation and design deliberation if driven as a collaborative process of negotiation of meaning and building of shared understanding. Consultation meetings can be seen as sensemaking processes in which participants make sense of problematic context and discover other people values and positions. The meeting conversations are interaction chances in which participants can build shared understanding of the problematic setting, by combining diverse positions and values in a common understanding. This process of sensemaking doesn't necessarily results in agreements on certain values or positions, however it helps understanding the different arguments and counterarguments at stake. This way the conversation dynamics draw a social picture which help to analyze the social, political and cultural setting in which planning develops and to explore possible implications of planning choices (aspects that could likely elude the technical analysis conduct by the planner).

In his article "Designing: Making sense Together in Practical Conversations" Forester claims that: "*the notion of design as sensemaking, an actively interpretative process, may capture and account for the behaviour in the community meeting much more adequately then does the metaphor of 'search*'" (Forester '84).

He gives evidence to his claim describing eight aspects of the sensemaking metaphor. Lets discuss them one by one in order to underline why this metaphor has been chosen to describe the approach to planning chosen in the thesis.

2.2.1 "Reading Problem Context and Desire"

Using Forester terms: "*The 'search' metaphor seeks a satisfactory solutions ones values and evaluative positions are known; in contrast the sensemaking metaphor leads us to examine the very genesis and articulation of those evaluative positions themselves*".

This is possible because discussions put sentences in context and make this context explicit. For context we mean the social context apart from the physical (geographical, dialogical, temporal etc) one. Forester says that every design activity even when developed in autonomy, is an expression of the designer ability to read and anticipate the context (both social and physical) and to make sense of it in relation to his design activity. We could say that the more a design activity is good the more he is the result of a deep appreciation of the design context.

"*If the real context of design is not appreciated, proposals are likely to be senseless….Donald Schon and others speak of balancing or fitting 'the whole and the parts'. In such cases, of course the formulation of the proper or truly significant context at hand is essential to the production of sense, meaning, or design.*" (ibid., 16)

2.2.2 "World Shaping"

In this second aspect of the sensemaking metaphor Forester claims that:

"*The sensemaking of design, the designer's work, is not simply a matter of instrumental problem solving it is a matter of altering, respecting, acknowledging, and shaping people's lived world as well. Of course designers cannot alter such "worlds" altogether freely, for as we shall see, the designers are in part products of their own cultures training and institutional settings."* (ibid. 17).

Thereby not only the functions of the design artefacts need to be discussed but the shaping of new 'worlds' and lived meaning of that 'world' need to be discussed through community meetings. We could even argue that while function matters can be better faced by the planning expertise, "world shaping" effects of design alternatives need to be compared with the actual and desirable meaning that local community give to their world.

2.2.3 "Practical Conversation and Communicative Action"

Another important aspects of the sensemaking metaphor is that in this conceptualization "*design activities evolves through the communicative actions of participants in practical conversations…the models of conversations, dialogue and question-response interactions allow for the native, historically rooted competences of participants to create new meaning together, regarding both means and ends."* (ibid.17)

Forester claims that as participants speak they are actually acting together by making claims, defending ideas and modifying positions. This seems to refer to the concepts of actions orientations of communicative acts ad defined by the speech act theory developed by Austin and then revised by Searle. However Forester doesn't specify how this theory of their following evolutions (like Habermas theory of communicative actions) relates with the sensemaking metaphor of planning. In the next section we will describe in details the two theories showing how both of them are useful to analyze planning conversations but unsuitable to represent them in their real ambiguous and uncertain character.

2.2.4 "Conversation and Learning"

This aspect of the sensemaking metaphor focuses on the learning opportunities that happen when "contra-dictions" occur. Contradictory sensemaking in conversation can be local manifestations of structural problems, that planner can confront with sooner of later in the planning process. Experiencing local implications of design activities can be a way to learn what are the structural problems of certain design activity trying to anticipate them and to correct on going the course of actions. This is a way to learn how to anticipate problems by conversation analysis.

2.2.5 "Practically Situated Actions"

This aspect of planning as sensemaking activity is centred on the relevance of the context. As discussed in the first aspect of Reading Problem Context and Desire

design doesn't happen in an abstract dimension but its development if bounded to the context and history of design events, especially when design is conceived as a collaborative and dialogical process of sensemaking developed throughout planning conversation.

Forester has indicated "*Speech or gesture or line or sketch wholly in the abstract would be meaningless, but the metaphor of design as sensemaking via conversation situates the designer work in a historical, practical context. Indeed, here attention must be paid to institutional and organizational context of practice, for design proposal must be formulated within the bounds of resources such as time, information, historical inheritance, political and cultural dispositions, not to say wealth and capital.*"

Conversations charges conversations' words and contents with the political, historical, organizational and social context in which design deliberation take place. Also, design proposal need to be realized within those constraints. Thereby, the analysis of the social and political constraints can imply both: i. discovering of less conflictual courses of action, ii. making easier and more effective the process of negotiation and defence of design proposal.

As confirmed by Forester analysis, " *Design conversations are bounded by constraints to be sure, and the analysis of the social and political character of those constraints is crucially important to the actual defence, negotiation and realization of specific design proposals.*"(ibid. 18).

2.2.6 "The Reproduction of Identity and Social Relations"

This aspect of the sensemaking metaphor is centred on the concept of multiple "roles" that speakers can take in a planning conversation. Forester argues that in "*ordinary speech, speakers are able to reproduce their contextual relationships and roles with one another just as they simultaneously communicate messages having certain contents.*"(ibid.18).

What is interesting is that these roles can both mirror the different social roles that a same person can play in a conversation, or can be interpreted in accordance with the role that the claim that person made has within the conversation.

In example the 'planner' can make a claim as an 'architect', or a 'local citizen' or as an 'environmental sympathizer', etc. Alternatively, depending on the *what* and *how* of what he said, the speaker can assume a different role in the conversation (he can be propositive, he can oppose to something, he be aggressive, he can establish roles, he can pose questions, …etc). However Forester doesn't details how these roles can or should be differentiated and how they can be detected.

In Forester conceptualization, design as sensemaking "*is not only productive and instrumental in character, but that it is reproductive and social-identity-shaping as well*". He wanted to underline the very function of planning conversation as way to define and make explicit social identities of participants. Therefore design as sensemaking is not just producing design forms and objects, but it is also a way to build social relations and identities.

2.2.7 "Political Rationality: Bounded Rationality and Ideology Critique"

This last aspect of the sensemaking and conversational metaphor focus on the biases and limitations of any planning conversation in terms of i. comprehensive and democratic representation of all interests (who participated in the

conversation? Who was excluded and why?); ii. choosing agreed terms to decide (Whose terms are used to make-sense of design problems?); iii. perceiving all people interest and satisfaction (whom interest is perceived and why?). Forester confronts the issue of the practically and historically situated character of design that Simon describes as its "necessarily bounded rationality", but from a political and ethical point of view.

In our approach (and in the thesis as a whole) we propose analyzing design deliberation as a possible way to enter in the very "reasons" of the inevitably design biases, as a way to study the character, reasons and implication of the bounded rationality followed in the design practice. In the community meetings one may be interested in knowing who attended, who was intentionally or unintentionally excluded. It could be important to understand if the designers were open to new design idea and ready to revise his plans according to the meeting results. Or on the contrary if "*they were simply co-opting the resident who attended, letting them 'blow off steam' while the work of design had already be completed*"(ibid.18).

Design process ambiguities and designer discretions are impossible to eliminate but tracing the design deliberation process and its planning conversations can monitor them. The concept of bounded rationality and the approach to design as 'search' would actually suggest finding any possible combination of design options that were suppressed. Nonetheless the 'search' metaphor doesn't give any indication of how these options can be identified in such complex political, social and dialogical context.

The model of design as sensemaking is indeed useful as well to be combined with the 'search' model, in order to explore the social, organizational and political ambiguities that the search model is not able to address.

According to Forester the metaphor of design as sensemaking requires to specify what's the institutional and historical settings of the participants in the conversation. This requirement aims first of all at monitoring the participatory planning process avoiding systematic bias and exclusion, since these biases influence the legitimacy of the design practice itself.

Forester claims that, beside the analysis of functional performances, rationality in planning depends on historical and aesthetical rationale, and legitimacy issues. Thereby *"designers who are blind to such issues of bias, institutional distortions, and ideology risk being unhappily surprised by other participants in design process who may raise these issues. Being forewarned may be quite practical and lead to better design outcomes as well*" (ibid.18).

Forewarning is a positive practical effect that design deliberation tracing and analysis can give to participatory planning in its on-going phase. Others relevant positive effects concern the possibility to trace the design rationale by tracing the collaborative sensemaking process which leaded to problem setting and design choices selection. In the following chapters we will describe these post-hoc advantages. We will propose a planning process memory system which enable new ways to study planning as social process and new ways to learn from successes/errors, trying to reckon good planning practices thus applying them to new planning cases.

Design as sensemaking through planning conversations is the theoretical approach chosen to build the planning process memory by mapping design deliberations and by creating a repository of planning experiences.

While the conversation goes on participants start creating expectations, having or changing impressions on claims, other people positions and about the matter at stake. All this happens because they do not have a clear idea of the design issues but they make-sense of it while the conversation goes on. According to this vision it is clear that each participant, indeed, reaches a view of the problem that mirror the discussion experience he took part in. Thereby the quality of this views, (that is to say i.e. how much the view is realistic, how much it is the results of a value-combining effort, how much it is shared, how deeply it is understood etc) directly depend on how community meetings' conversation has been driven, with which purposes, with which method, with which means and support.

Forester doesn't explain how these conversations can be driven and how the sensemaking metaphor can find practical applications. He recognize that community meetings are unique occasion to understand expression of feelings, to generate new ideas, to address the political dimension of planning but it doesn't' give any concrete idea on how planner can actually drive their design activity as sensemaking process.

2.3 A Sensemaking Approach to Planning

The thesis contribution in his whole consists of a set of theoretical references, methods and tools to address this paradigm of participatory planning and design as collaborative sensemaking process performed through deliberation.

Interpreting planning as collaborative design activity, and interpreting design as a sensemaking process means to appreciate the design context throughout a process of interaction and deliberation between participants. During this process participants negotiate meanings and make sense of the design context in different and contingent ways. Most of this sensemaking activity is developed while performing dialogues and conversations about design issues but it incorporate and enlarge to a far wider context which include personal and group positions, expectations and believes. These positions, expectations and believes take form and modify themselves as soon as they are made explicit in the conversation acts (expressed statements). Design conversations develop in a continuous process of 'positions declaration' and 'comparison with the audit'. When a participant makes a claim, many are the possible events that can occur. The claim can receive opposition, or agreement, or it can be ignored. Each on of these cases can then be specified differently and different explanations can be given for the event to be. I.e. the opposition can come form a single person or from a group. If the opposition comes from a single person, the reason for this can be clearly in the object of the opposition itself (conflicting issues) or it can be ambiguously hidden in organizational or political matters (conflicting powers). If the opposition comes from a group, the group can be homogeneous (people belonging to the same organization) or heterogeneous. In the first case the initial claim can probably have a high impact on a specific interest group or it can be have wider implication on several groups. Several analysis and considerations can be similarly done on the

'hidden' nature of arguments and counterarguments raised in a community meeting.

The first and main outcome of analyzing design deliberation in this way is the possibility to start a process of 'knowing' of the social and organizational context in which the design develops. Designing as collaborative sensemaking process is a process of:

- discovering the deep implications and impacts of design practices,
- exploring and experiencing new unexpected oppositions and/or synergic forces,
- checking strategy feasibility,
- defining together the problem setting,
- and collaboratively selecting design alternatives.

All that while making explicit the group discussions, thus reasoning about the way the group made-sense of the design matters. This sensemaking process shapes the design knowledge base the group generated through interaction and communication in the participatory design practice.

Thereby the main advantage to approach planning as sensemaking process is the possibility to draws a picture of the panning process as social process by tracing design deliberation.

2.4 A new Approach to Participatory Planning: Facing Ambiguity Problems Through Transparency Seeking

Our intention here is not to address problems of policymaking and legitimacy of planning. Using Forester metaphor we can say that we are still interested to problem of uncertainty. With this we means that we are looking at the technical dimension of planning, we want to focus on understanding the role of planning expertise in modern participatory planning practice. But while doing this we need to look at ambiguity problems as coterminous with uncertainty ones. This need is due to the consideration that ambiguity problems are unavoidable in any planning practice. This is due to two grade considerations:

- Ambiguity problems are connatural to the complexity of the issues that planning addresses (wicked problems as defined in (Rittel and Webber '84) and
- Ambiguity problems are connatural to the character of planning objects (land, human and environmental resources, common goods, social spaces, etc).

Given this understanding planners addressing 'uncertainty' matters cannot avoid to engage in the analysis of 'ambiguity' matters.

In the attempt of doing this the role of participation in planning practices is to involve new voices in the value definition and planning discussion, in order to combine this values in new creative, strategic and context oriented ways.

Moreover the technical dimension of planning has a new challenge to address that is how to analyze uncertainty problems, that is to say how to study the political realm of planning practices by driving and studying the planning process as a social process. This means to take into consideration problems of institutional and practical constraints, political contingency, plurality of values, coexistence of conflicting interests all equally legitimate etc.

The approach proposed in the thesis aims at facing ambiguity problems with non-political methods and tools. This means try to face uncertainty problem wondering what new technical expertise, methods and tools can support participatory planning practice, while respecting his unavoidable and connatural complexity and policy dimension.

The approach proposed in the thesis is to address ambiguity problems through transparency seeking. If ambiguity and uncertainty cannot be solved, transparency of choices and explanation of reasons behind decisions is the only way if not to make planning decision legitimate at least to make them open to present and future discussions, revisions, improvements and even contestations.

Different community groups are not legitimate to pretend that their needs and will are taken into consideration both despite other groups and people wills, and despite technical, political and economic concerns. Planning as consensus seeking can be a utopian planning theory, because consensus is improbable or even impossible to be reached, and to some extent it can force people to unfair compromises on personal values that nobody should be pushed or willing to renounce to.

What is and can be legitimate is the 'knowing' of what values have been taken in consideration and why, which options have been selected and why, what knowledge has contribute to this values and options definition, and what decisions have been taken and why.

The accent is on explaining 'the why', disclosing motives and reasoning for positions, decisions and actions to be. This approach to planning argues that legitimacy bases, above all, on transparency of planning process. Legitimacy doesn't come just from a process of opening up to citizen and interest groups participation. A planning process is legitimate when after the participation duty is expressed, the inevitable closing dawn process of community knowledge interpretation, planning choices selection and political decision is made transparent and disclose to the public so that it can furthermore be explored, evaluated and judged.

To do so planners should:

- freely share and exchange information and knowledge used and generate in the planning process with all the participants to the process,
- track and represent design deliberation so that community meetings can be explored afterward to analyze and understand the planning process as social process of interaction and negotiation between participants
- disclose reasons behind planning choices and policy-making decisions in order to explain 'the why' of planning process evolution.

2.5 Speech as Mean for Acting and Making-Sense Together

The conceptualization of speech as mean for coordinating actions has been introduced by the speech act theory developed by Austin in the 60th (Austin '62) and then revised by Searle in the 70th (Searle '69). According to speech act theory the minimal unit of human communication is not a sentence or a general expression, but rather the performance of certain kinds of language acts such as requests and promises etc. The speech act theory classify this speech acts as follows. Every speech act is an attempt of a Speaker (S) to communicate to a Hearer (H) some contents to persuade H to do something. Speeches acts can be classified basing on the speaker intention to:

- to assert something that he believes being true: "*It is too late to do this*!" "*There is an active local community in this area*": assertive speech acts,
- to question or propose something that S want H to do (i.e. questions are part of this group, S want H to answer the question or to takes a course of action if the proposed direction) – "*Do you thing this is a relevant problem for this community?*" "*Let's discuss again the transport problem*": directive speech acts;
- to declare an intention to do something, this speech act describe a commitment in a certain future course of action- "*I will support this idea*" "*I promise I will make a petition to decide on this point*": commissive speech acts;
- to express a personal position on something, the intention of the speaker in this case is not necessarily to generate an action, rather he describes a personal attitude toward something- "*This idea is exiting*!" "*I beg your pardon for asking this*": expressive speech acts;
- to declare something, in this case S is making a claim for true, he claim that his statement mirrors the reality: "*Fishing is forbidden in this area*": declarative speech acts.

According to the speech act theory communication succeed just when the Hearer act accordingly with the speaker speech act intention.

In this theory t is difficult to distinguish between declarative and assertive speech acts; indeed, Searle claims that it is possible to have declarative-assertive acts in which it is impossible to know if the speaker is telling the true or actually his intension is to lie. This classification that is too focused on speaker intention and psychological position is actually of little use in case like community meetings where speakers are often driven by less clear intentions, where the conversations are often not orientate to produce immediate actions and speakers are always willing just to be heard, give their position and share ideas with the group.

Habermas takes the theory of speech acts as a starting point and build on it his theory of communicative action. The main different between Habermass theory of communicative action and Austin and Searle theory of communicative act is that Habermass consider the possibility that a communicative acts doesn't succeed (in Searle's view) because it hides problems of validity of the assumption made. If Habermass theory these problems can be solved by negotiation and these speeches can lead to successful communication acts (for an interesting comparison of the two theories see (Dietz and Widdershoven '91). Habermass claims that: "*Only those speech*

acts to which the speaker assigns criticisable validity claims do motivate the hearer on their own to accept the speech act offer, and only because of this foundation do they become the mechanism for effective coordination of action" ((Habermas '81): 409).

Habermass claims that in order a speech act to work the communication need to be oriented towards mutual agreement, and participants should perform negotiations about the claims made.

In our cases what makes interesting Habermass theory is his distinction between strategic actions and communicative actions, and the distinction in the three worlds of reference for speech acts: the objective, the social and the subjective world. To each world on specific speech act is referred: claim to true refer to the objective world, claim to justice refer to the subjective world and claim to sincerity refer to the personal world of the speaker.

This classification can help in analyzing discourses trying to focus on the very nature of the problem behind them. If it is a problem of objective definition of the problem setting, is it a problem of objective world and it will be argued with claim to true. If on the contrary the claims are claims to justice like request of social services, denounces of social divide etc it means that social action need to be taken. Moreover this classification help to distinguish personal's world from social's world claims, and it suggest a method to monitor and check claims to sincerity. Is it true that the speaker is genuine in performing its speech act? This is a relevant matter in order to understand the impact that the speech act should have on the design process, and in order to understand whether the raised issue calls for a technical, social or political move to be addressed and discussed.

Planning discourses and design deliberation in public planning fields' deals with 'uncertainty' and 'ambiguity' issues, they incorporate both social and strategic matters. Both are legitimate but distinguishing between these two aspects can help to improve the communicative actions within planning discourses.

However the orientation toward agreement cannot be given for guarantee and it is often difficult to reach because it requires a certain level of trust between speakers and hearers that is difficult and sometime impossible to gain.

Nonetheless Habermass classification offers a good framework to analyze planning discourse and distinguish between social, technical and sincerity problems. In section 9.4.2, when discussing the information processing procedure to analyse planning conversation, we will use a taxonomy inspired to Habermas's work in order to distinguish between the very characters of the issues raised in planning conversations.

2.6 Representing Deliberation: The Challenges of the Modern Planning Arenas

As Innes and Booher claim in their paper "Public Participation in Planning: New Strategies for the 21st Century":

"*It is time to face the facts we all know, but prefer to ignore. The traditional methods of public participation in government decision-making simply do not work. They do not achieve genuine participation in planning or decisions; they do not provide significant information to public officials*

that makes a difference to their actions; they do not satisfy members of the public that they are being heard; they do not improve the decisions that agencies and public officials make; and they do not represent a broad spectrum of the public. Worse yet, they often antagonize the members of the public who do try to work through these methods. Moreover, they pit members of the public against each other as they each feel compelled to speak of the issues in polarizing terms to get their points across — making it even more difficult for decision makers to sort through what they hear, much less to make a choice. Most often these methods discourage busy and thoughtful individuals from wasting their time in going through what appear to be nothing more than rituals designed to satisfy legal requirements."

(Innes and Booher '04)

As traditional methods of public participation, Innes and Booher refer to traditional hearings meetings (in which speakers have no more then three minute each to speak, despite the relevance of the interest they represent or the importance of the issue they raised) or review and comment procedures such as official opposition letters and reports. Innes and Booher claim that these methods have proved to be ineffective and even counterproductive because their failures have triggered process of lousing trust in public participation initiatives both from the public, the decision-makers and the planners. A first response to these failures came from the political and social scientist community that proposed new survey methods: such as opinion polls, focus groups, and the modern web-based form of public forum, blogs etc. these methods can be used to have an idea of how the public 'feels' about certain initiatives. Ideally information gathered can be used from decision-makers to inform their decisions but experiences show that this is unlikely. Indeed, usually the public is called to participate without being well informed on the planning issue at stake, thereby interventions are often difficult to be contextualized to the complex and continuously evolving policy making process. This make comments, forum posts and opinion poll's results often not up-to-date and then difficult to be reconnected to the on going process issues, despite any scientific effort to recombine and make sense of them. Furthermore these methods do not engage decision makers in a real dialogue with the community. People cannot raise hands, make questions of express complains which have immediate listening and answer, thereby the possibility for the community to participate to the process is even less then in the classical form of participation.

New cooperative methods of public involvement interactive collaborative methods we believe will be the most important in the next century are these interactive collaborative methods of discourse allowing multi-way communication around tasks and issues, involving the public directly with planners and decision makers, and allowing real learning and change to take place on all sides.

At present these methods are used informally in small groups of people and they are not part of the legislation requirements and administrative practice. One of the case studies we will present on the second part of the thesis an example of these new interactive and collaborative methods that have been committed by a local institution but driven by a non-governmental organization of social promotion.

Interactive and collaborative methods normally require face-to-face interaction between citizens, planners and decision makers. One method is the so-called "planning character". These methods base on the principle that new creative ideas

can be reached involving a group of people in an intensive and collaborative focus work around a planning issue. This method aims to trigger creative ideas and to involve citizen or other interest subjects to vision and imagine some desirable futures, and possible strategies to reach it.

2.7 Conclusions

In this chapter we described the conceptual implications of considering planning as a collaborative design practice, and design as sensemaking process. We explain the reasons and implication of choosing this conversational metaphor for participatory planning practices and we discussed a new approach to participatory planning which aims at facing ambiguity problems through transparency seeking. Within this context and with this approach to planning this thesis propose a set of methods and tools to manage knowledge in planning with the broader aim in mind to enable transparency (transparent knowledge tracing, integration and sharing) in participatory planning practices. In particular next chapter introduce the concept of 'knowledges' in planning. The definition of knowledge we will refer to in the thesis is discussed and our knowledge-oriented approach to planning is discussed and contextualized both in the planning and knowledge management literature.

3 Knowledge in Planning

In this chapter we discuss the role of knowledge in participatory planning focusing on the challenging task to combine the multiple character of knowledge handled in these practices with the operative role it should play in the planning process in order to raise and enhance information into rational actions toward certain goals.

First we discuss the character of distribution and extensiveness of knowledge in participatory planning. The definition of knowledge adopted in the thesis will be motivated in the literature analysis on the topic both in planning, organizational and information technology field. Furthermore a knowledge-dimensions taxonomy in the domain of planning will be envisioned explaining why these are considered to be key dimensions in order to manage this knowledge in the planning actions.

Furthermore the chapter discusses the need for planners and planning practices to enable and combine two contrasting processes.

An Opening-up process that aims at enlarging participation in knowledge contributions and a Closing-down process that aims at structuring, identifying and using relevant knowledge for planning actions. In particular the chapter discuss the need for specific methods and practices to enlarging the right to knowledge contribution while preserving duty and accountability when performing planning actions. New tools and methods to support participatory planning practices are explored devoted to preserve and disclose knowledge sources while at the same time motivating knowledge uses and evolutions.

3.1 Character and Role of Knowledge in Participatory Planning

Growing attention is being paid in the planning theory field to the characterization of knowledge in planning. Classical science suggests that knowledge is the 'true' understanding and explanation of a phenomenon. Thereby the rational comprehensive planner should gather knowledge about the planning issue in order to construct reliable predictions and implement successful plans. The postmodern crisis of science brought to change the approach to knowledge in planning and opened the discussion to new dilemmas: who held or can acquire knowledge and how? Drawing on H. Simon theory of bounded rationality planners stared being aware that a comprehensive analysis and understanding of the planning issues were not feasible thereby they had to rely on partial knowledge and face the uncertainty of the future. However the definition of knowledge behind these arguments seems to remain the same. Even though the amount and quality of knowledge is limited by the complexity of reality or from the lack of information, knowledge is always something that 'tell how things are, it is understanding and explanation of the true.'

What seems to change in the post-modern planning culture is who is entrusted to own or acquire knowledge, that is to say who or what is the knowledge sources. The pluralism shift brings out in the conversation the concept of 'listening to different voices' and 'valuing lay people knowledge and expertise'. This hopefully should bring to enlarge the knowledge base that planners rely on but it does not

seems to imply a change in the epistemological definition of knowledge. As an effect of this, a new concept of knowledges enters in the planning domain dictionary. Not very clearly defined, it is expression of the general process and feeling of opening up to the community in policy making and planning practice. Community become active and important contributor to the knowledge base planners should rely on to build knowledge in planning.

The term knowledges started being used especially in the feminist literature (Haraway '88; Harding '91; Sandercock '98; Collins '00) which aims to the inclusion of women and minorities voices in the planning discussion; also, the term knowledges appears in the discussion about expertise and lay knowledge divide and it is a new language expression to claim the lay people right to contribute to knowledge (Wynne '96). This is used especially in the environmental planning field in which the first and more productive results of citizenship involvement to planning choices have been proved.

Seemingly, if we look at the social science debate in the same decades we can recognize that knowledge is no more an objective entity produced by expert scientist but it is a social construction, which involve different people and is generated trough interaction within the social context. This new assumption implies that whatever (institution, person, or organization) which generates knowledge will not ensure necessarily neutrality (Irwin '95). Does this statement imply that knowledge can also be 'not neutral'? Does this means thereby that knowledge stops to be something unquestionably true? Or rather it means that there can be different knowledges on the same phenomenon that favour different people or groups within the society? In this case what is not neutral is the action that, basing on that knowledge, can be overtaken, and not the knowledge itself.

It is not clear in the planning literature what is the definition of knowledge subtending the different planning theories. What seems to be unquestionable is that knowledge in modern planning is addressed as something that is multiple; it is not anymore prerogative of the rational-analyst planner; and diverse people and social processes are and need to be involved in order to create knowledge in planning. These seem to be agreed principles in the planning community but not clear definition of what is knowledge in planning can be find.

A key article has been published in 2007 on Planning Theory Journal discussing the need to re-examine the role of knowledge within planning theory (Rydin '07). The article reviews the emerging literature on multiple knowledges in planning theory and sociology. The author offers a definition of knowledge in planning:

"*Knowledge differs from information and data in that the specification of a causal relationship is central to knowledge. This is why knowledge is of such central relevance to planning. Since planning seeks to create specific impacts, planners need to understand how such impacts follow from specific planning actions; they need to understand the causal relationships between action and impact….This article argues for the more explicit recognition that knowledge of such causal relationships is an important part of planning practice and then works through the institutional implications of such a recognition*."

(Rydin '07)

Rydin argues that knowledge is of central relevance in planning because it explains (or should explain) the causal relationship between planning actions and impacts of these actions on planning systems. Although we agree with the assumption that knowledge imply a certain kind of relationship between information, data or other knowledge that allow to infer new facts, information and data; we are less confident in that knowledge by itself can univocally forecast planning impacts, and determine the success of planning actions. We consider planning impacts very much dependent on many social and opportunistic factors which can be hardly forecasted. Measures and actions other then knowledge creation can be undertaken at social level in order to support the implementation and to reduce the oppositions to planning actions. However knowledge of social environment and community disposition toward planning actions can undoubtedly augment the probability of that planning actions move toward their goals.

What seems to be more relevant for our analysis is that Rydin makes a precise distinction between knowledge and 'knowledge claims'. She defines a knowledge claim as "claim to understanding certain causal relationships". Many other claims can be asserted within a planning process, they can be ethical claims, beliefs, aesthetic claims, personal claims and all these claims are relevant for developing planning actions; but there is difference between claims and knowledge claims, and between knowledge claims and planning knowledge. This distinction have a specific relevance if we think about knowledge used, created and discovered during participatory planning processes. Consultation meetings, groups of internet meetings, roundtables and public inquiry are driven to engage community in the planning process by gathering claims, opinion and lay knowledge. Unlike other more radical planner (Sandercock '98) Rydin doesn't consider all the claims of local communities as form of knowledge per se. Collins and Evans also sustain this position. They consider that, even though a local stakeholder claims for local and experiential knowledge this doesn't necessarily imply it to be knowledge (Collins and Evans '02). Besides, we can add that it doesn't imply that specific claim to be 'relevant' knowledge for the planning process. We define this knowledge as planning knowledge.

Both Rydin and Collins&Evans drive their arguments to make the case that a process of claims testing is needed in order to identify knowledge claims from general claims. Nonetheless what is particularly interesting to underline in our analysis is that they try to bridge the value of listening to diverse voices to the value of developing planning knowledge that is in some way reliable to be the base for planning action. Who should test and evaluate the validity of knowledge claim is not a matter we intend to address here, but we want to make the point that probably a clarification is needed on what knowledge in planning is, where is comes from and how is different form general statements, information, and data.

3.2 A Definition of Knowledge in Planning

It is our considered opinion that we do not need another epistemological shift in the definition of knowledge. Many definitions of knowledge have been given in the history time have been given in the field of philosophy, psychology, educations, organization science etc. We do not intend to address the discussion or pretend to find the right answer that is valid for all planning theories and approaches.

Nonetheless we feel the pressure to choose a definition that can drive the understanding of the research presented in the thesis. We will then try to give the definition of knowledge that will be used in the following.

As we already discussed in chapter 1 the thesis develops in an interdisciplinary field which blends between organizational science, computer science and planning.

We will present and discuss three definitions that are in tuning with our understanding and on which we build our definition of knowledge in planning.

In Artificial Intelligence there is a dominant, and well-established conception of knowledge which derives from the famous paper written by Allen Newell in which he introduces the Knowledge Level Hypothesis (Newell '82):

"*There exists a distinct computer systems level, lying immediately above the symbol level, which is characterised by knowledge as the medium and the principle of rationality as the law of behaviour*".

Where the principle of rationality is formulated as follows:

"*If an agent has knowledge that one of its actions will lead to one of its goals, then the agent will select that action*."

In other words, Allen Newell defines knowledge as the capacity to act rationally towards some goals. The Knowledge Level Hypothesis closely relates knowledge to actions, and in fact, it seems to imply that there is no knowledge without action. We refer to this definition to point out that if we think about computer technology supporting knowledge management and interaction in planning we are strictly oblige to bear in mind that computers need information to be structures and knowledge to be formally expressed in order to be at any moment taken into consideration. Even though we believe that certain kind of reasoning and inferences in the planning domain needs to remain human prerogative, we also encourage attempts done in the fields of new technology to 'extend' and 'augment' our capacity to visualize, understand and reason on reality.

In order to build an overall coherence in the definition of knowledge in planning we have then to restrict the given definition to the field of a "computer agents" being aware that human agent are not prone to follow in all the cases the rules of rationality to make their decision and implement their actions. Many other components such as emotions, believe, wisdom, praxis etc can motivate our action and make then for the other out behaviour being irrational. This mean that computer supported reasoning and knowledge-base system should be applied with attention to the knowledge they are formulating and processing. Certain kind of knowledge is not suitable to be processed with such a system. Nonetheless having a knowledge definition that is coherent with AI principles opens the opportunities to future development of new technology for planning that can help not to take decision but to alert, suggest and even discover new knowledge on which to base decisions.

3.2.1 A Pragmatic Approach to Knowledge

In the organizational and business management domain the seminal work of Donald Schön introduce the concept of 'knowledge-in-action'. According to Schön knowledge have some tacit component that in not evident until it manifest within the action. Schön then suggest that this knowledge in action need to be grasped and

represented. The way to grasp tacit knowledge is reflecting on and about the course of action. Reflecting is the base for learning what worked and what did not work so that better action can be applied in future practices. This pragmatic approach to knowledge is also sustained by the philosopher Richard Rorty suggests that knowledge in social studies is contingency and incomplete (Rorty '89). It is contingent because it emerges in the flow of action, that is the context in which decision and plans are made.

This conception of knowledge-in-action seems to be coherent with Nonaka's definition of knowledge. He borrows from Plato the definition of knowledge as "justified true belief" with an accent on the justified dimension of the belief instead of on the definition of an absolute true. This specification is a good compromise to explain what the human component effect the definition and creation of knowledge. Knowledge created in social contexts is less prone to be considered incontestable expression of an absolute true. A pragmatic approach to knowledge and a knowledge oriented approach to planning need to base on a definition of knowledge that is rigorous, so that it can still allow planner to act in a way that is to some extent rationally arguable, but coherent with the complexity, uncertainty and emergent character of the social context in which planning intervene. The definition of knowledge offered by Nonaka seems to bridge these two aspects:

"*Knowledge is dynamic, since it is created in social interactions among individuals and organizations. Knowledge is context-specific, as it depends on a particular time and space. Without being put in context, it is just information, not knowledge….information become knowledge when it is interpreted by individual and given a context and anchored in the beliefs and commitments of individuals….Knowledge is a dynamic human process of justifying personal belief toward the 'truth'.* "

In our study we adopt Nonaka's vision of knowledge as: dynamic, created in social interaction and highly context dependent. Moreover we do not consider the action to put information in context a sufficient way to create knowledge out of that information. Context is important in order to details the factors of the interaction process that is generating knowledge, but this is just information about the social interaction of knowledge generation. In order to build knowledge out of this information an individual needs to interpret that information according to his experiences, past knowledge and hidden believes, emotions and desires. Is our considered opinion that knowledge is always a human and often creative act of sensemaking of a melting pot of information, experiences, and knowledge, believes and wisdom. It is a human process of relating, comparing and understanding which an individual performs by blending between facts, information, believes, perceptions, emotions, past knowledge, experience, wisdom and anything else, that can be used or done to make sense of something and to act.

That's way this process cannot be just entrusted to an artificial brain and that's way it cannot simply be the result of an operation of putting information in context, no matter how sophisticated the information and the context are. A so human oriented definition should not lead to misunderstanding. Knowledge creation is a human process but this does not imply that this process has to be irrational. Any claim can be based on a mix of interpreted beliefs, passions but in order to be considered knowledge needs to be justifiable as true. This process of justification implies the effort by the individual to make explicit the logical relationships which she made

sense of to create that knowledge. Moreover if this specification is not possible or aware to the individual, that knowledge is 'tacit knowledge'. Tacit knowledge is highly personal and hard to formalize. On this concept of tacit knowledge there are we are facing what tacit knowledge. Tacit knowledge the literature seems to be divided. All scientists seem to agree that there is a component of the human capability of knowing that is difficult to formalize, explain and some time also to understand even for the person that is creating the knowledge. Polany's approach in example states that there is a tacit component in the art of knowing that is inexpressible and in this sense it contrast the Nonaka model of knowledge creation throughout a spiral which convert tacit in explicit knowledge (Polanyi '83). Researchers that investigate Community of Practices and situated knowing support this position. Tacit knowledge cannot be converted in explicit knowledge because tacit knowledge is embedded in practices and actions of the people and organization in which that knowledge is being created (Brown and Duguid '91; Lave and Wenger '91) That's why they talks about 'knowing in action' as *"situated, embodied, practiced, experimental, and always-provisional activity"(*Amin and Roberts '08).

Even though we agree that knowledge is situated and embedded in action in the sense that is embedded in action because action give knowledge the possibility to emerge, and express in always novel and often creative and unpredictable way we also believe that the knowledge is a concept that is worth to maintain for many different reasons:

First of all because in the era of information overflow, in which the congestion of definitions and interpretations make more and more difficult to communicate, knowledge is a simple, intuitive and familiar term that everybody understand and a good base do start disambiguation of concepts and specification of meanings.

A second and more relevant reason is think that there is a certain kind of knowledge that is socially created and socially interpreted and used there are other knowledge typology that much more easily and effectively can be formalized and transferred. See in example knowledge about the geographical, geological morphology of a region or a city, knowledge about biological form of life and statistical distribution of miserable factors etc. All this knowledges are relevant for planning such as other forms of social organizational and political knowledge. Should we use different terms to characterize them just because there are different characteristics in the way we define, create, and represent these knowledge? Isn't it already different to build knowledge on the mobility flows of a city from the definition of the maps of hydrological risks?

3.2.2 Knowledge Gathered in Planning Conversation

We consider knowledge in planning as the expression of a process of making sense of facts, information, row data, claims and other knowledge of different nature and source. Each logically connected chain of these elements, interpreted or expressed in the light of a planning issue, can be considered planning knowledge and can be expressed and communicated as knowledge claim. Whether this knowledge is in form of claim raised form a local stakeholder who makes sense of its knowledge and understanding or it is the result of an expert analysis of scientific evidences doesn't matter. These are just two examples of the multiple forms of knowledges that have equal relevance for planning. A different ordering in the scale of priorities can

depend on the planning problem at stake and the specific addressed matter, but the several knowledge typologies form several knowledge sources need to be considered and analysed with same engagement in term of time and resources. What is relevant to underline is that knowledge is different form information and data because it express some kind of interpretation and reasoning on other data, information or knowledge. The difference between information and knowledge refers to the personal attitude of an individual to interpret a set of data (information) in a personal way and to elaborate them starting from our experiences, background, needs and objectives. The result of this process signs the pass between information and knowledge.

In the specific case of this thesis we are interested to capturing and managing information and knowledge created in participatory planning practices (like community meeting, team group meetings etc). Mainly, we are interested in the analysis of knowledge embedded and generated in planning conversation. No matter if conversations are synchronous or asynchronous, face-to-face or at distance, if they happened in real world settings or in virtual environments. We are interested in communication and interaction between people and we investigate knowledge and information used, exchanged and generated within planning conversation. Thereby the question to pose is: Are the participants' claims forms of knowledge?

Our answer is: not all the claims. As specifies in section 3.1 by Rydin contribution, knowledge claims a just a specific type of claims that can be raised.

Let's try to explain better what we mean for knowledge claim with an example. A statement of an elder person of a local community who says:

"*I remember when here was all green and I could see from my house the church campanile. We used to spend time watching the sunrise and the day was passing slowly and calm…*"

In some of the planning literature this claim would be considered local knowledge. According to our definition of knowledge in planning this is a claim from which we can gather much historical information on the way of life of local community, on the development on the settlement during the years, and this information can be very useful for the planning process, but still this is not knowledge because it doesn't show any logical implication between facts or information.

On the contrary a claim as:

"*We need structures which helps private companies to open new activities in the neighbourhood, in this way we can foster the incoming of new people*"

This claim can be considered a knowledge claim. Indeed we can deduce that: If we support private company to open new activities in the neighbourhood this will attract new people in the neighbourhood. The knowledge expressed form the stakeholder can be schematized as:

Structures to support private companies ->(imply) -> New activities opened -> (imply) -> new people attracted.

Furthermore the knowledge claim can be tested against many other claims, knowledge and considerations. It can be considered or not relevant for the planning process. Despite this it is expression of some kind of causal relationships between

information, facts and hypothesized consequences that the local stakeholders, inferred basing on his experience.

Thereby when we look at planning conversations we should distinguish between knowledge claims and general claims. This distinction is key for different reasons. First of all it helps to distinguish between information about/by the local community and local knowledge. Information about local community is information about some aspect of the local community that can be obtained in many different ways, with experts studies, statistical analysis, interviews etc. information by the local communities are information gathered by the community meetings, that is to say information gathered from the stakeholders (i.e. claim of the elder person reported here above). On the contrary local knowledge is knowledge created and interpreted by lay people, they actually are expressed in forms of knowledge claims.

Using information about the local community and/or information given by the local community planners can then construct knowledge about the local community, that is actually what planners do when they write planning reports on participatory planning experiences. Just a part of the knowledge that is reported in planning reports on participatory experiences is local knowledge; the most of it is rather knowledge that planners generates along the participatory planning process and during their interaction with the local stakeholders. It is not local knowledge this is knowledge about the local. It is fair and important to unhide this difference that actually sign a first important interpretation gap that planner already do when reporting participatory experiences.

In any case it remain of key importance for the planning process to take into consideration knowledge about the community, the local environment and the people feelings, desire and opinion despite the process of making sense of information to generate knowledge is done by the stakeholders or by the planning teem.

This knowledge is one of the key knowledge that does and should come into play in planning and we will refer to it in the thesis as social knowledge. Social knowledge is referred to as knowledge *about*, *by* and *with* the social environment. It is knowledge specifically created by the interaction of the different actors in the society that collaborate in the planning practice and it is the results of their actions and impacts on social context. Social knowledge is knowledge about connections, communication and exchange between social actors in the social context. To say it differently it is the result of a social process of *knowing in action* (Blackler '95; Boland and Tenkasi '95; Choo '98; Amin and Roberts '08). In the thesis we will focus on the forms, the processes and the means in which social knowledge can be created during planning conversations.

Social knowledge is distinguished by:

- knowledge sources (data, information or knowledge used to create knowledge)
- knowledge interpreter (who build the logical connections between information, facts and knowledge, who is making sense of the issue and generates the knowledge)

- knowledge addressee (the person, organization or agency to which the knowledge is or should be addressed)

Knowledge interpreters specify who generated the knowledge out of experiences, facts, data, information and other knowledge that are in play. Knowledge interpreters can be grouped in three main categories:

- the planning team; the team can create knowledge by reflecting and analysing on social information gathered from the planning conversations,
- the lay people; they directly express and communicate knowledge in form of knowledge claims during planning conversations,
- community groups, local institution and organizations; they collaboratively create knowledge throughout a process of negotiation of meanings and building of shared understanding. This can happen during ad hoc participatory design experiences.

These three categories can be restated focusing on the knowledge typology they create, that are:

- *Local knowledge*: knowledge directly stated by the lay people in form of knowledge claims
- *Knowledge of the local*: socially oriented knowledge; it focus and it is created by the planning team throughout a deep analysis on social dynamics, interests, implications and objectives
- *Collective Knowledge*: Knowledge generated collectively by the stakeholder trough explicit agreements and negotiation of meaning and understanding.

This last typology of knowledge is collectively generated and thereby it is more difficult to be achieved. Indeed, groups of people differ for attitudes, experiences, background, needs and objectives so that even starting from the same set of information and knowledge they interpret and elaborate them in different ways. So an intense process of negotiation of meanings has to be supported in order to build collective knowledge.

Moreover collective knowledge is generated by an interaction process which has the aim to bring the team toward agreement and the collaboratively definition of knowledge. This process happen through planning conversations thereby it can generate as an outcome several knowledge claims from the participants which shape the collaborative knowledge form the group.

These three knowledge categories, *local knowledge*, *knowledge of the loca*l and *collective knowledge*, are three categories of interpretation of the information and knowledge gathered through planning conversation. This categorization help to reflect on what knowledge really cam from the community and is part of the community wisdom and what indeed is social knowledge created about the social endeavour by the planning team or collaborative created during the planning process.

In order to reflect this multiple meaning of information and knowledge, in the context of the memory platform we will consider that information and knowledge in planning conversation can be expressed in form of three main typologies: general claims, design artefacts and knowledge claims. Knowledge claims are the only form of knowledge directly captured and represented by the memory system, while general claims and design artefacts (maps, documents, images, physical and virtual

models etc) are considered as information and they have been referred to as knowledge fragments. They have been defined knowledge fragments for two reasons: i. to underline that they are expression of a process of knowing in action (in this case a speech act) from the planning stakeholders, thereby they are fragments of the knowledge of involved stakeholders; and ii. they constitute the information base the planning organization can use to create new knowledge in the planning process; thereby they are potential fragments of the planning knowledge to be created. Thereby in the following when we refer without distinction to information and knowledge we are referring to knowledge fragments (information) and knowledge claims (local knowledge by the lay people) as defined in this classification.

3.3 Knowledge Management in Participatory Planning

Knowledge management can be defined as the process by which an individual or organization convert available information into relevant knowledge to achieve certain aims. Knowledge management reviews suggest the distinction between first generation and second-generation KM strategies. The first generation KM strategies focus on two points:

- Systematizing and organizing existing knowledge
- Enhancing knowledge sharing;

While the second generation KM strategies focus on enhancing the condition for innovation and knowledge creation.

Our approach to KM applied to the planning field merge the two approaches and looks for methods and tools to organize and structure information about the planning process in order to create relevant knowledge about the process. This process of knowledge creation happens through creative exploration and interpretation of the available information opportunely structured and represented in a process-memory system. At the same time we provide environments and tools for exchanging this knowledge and information and sharing it through diverse organizations and environments.

The urban and environmental panning fields are less mature in the development of KM strategies and studies compared to other field of research in which KM was born and developed. A very large proportion of the literature on KM is developed in the corporate sector while in the environmental and urban planning domain these concepts are still looking for clear definition, exploration, and study. Thereby it is still premature to talk about first and second-generation KM strategies, because concepts and tools still need to be discussed and clearly defined in the planning scientific community. That's why a literature review on KM in the planning field is particularly challenging and require continue references to contributions in other field of research, interpreted in the light of planning problems. This review has then the aim to build an operational definition of knowledge and knowledge management in the planning domain. These definitions will be used in the context of the thesis, in order to have a clear reference to what we mean when using this concepts.

Several different frameworks for describing the nature of KM have been developed in the business community. An interesting review of KM frameworks has been done by Holdsapple and Joshi (Holsapple and Joshi '99). These frameworks can be organized in tow main categories: descriptive framework aiming at defining the aspects of KM phenomena; and prescriptive frameworks that describe the methodologies to follow to enable KM practice within organizations.

Between the prescriptive framework we will focus on the one proposed by Choo in his book "The Knowing organization – How organizations use information to construct meaning, create knowledge and make decision"(Choo '98). The character that makes Choo approach to KM particularly close to the approach sustained by our work is the accents he poses on information-use to create knowledge and the scheme of knowing-organization he proposes (Figure 3-1).

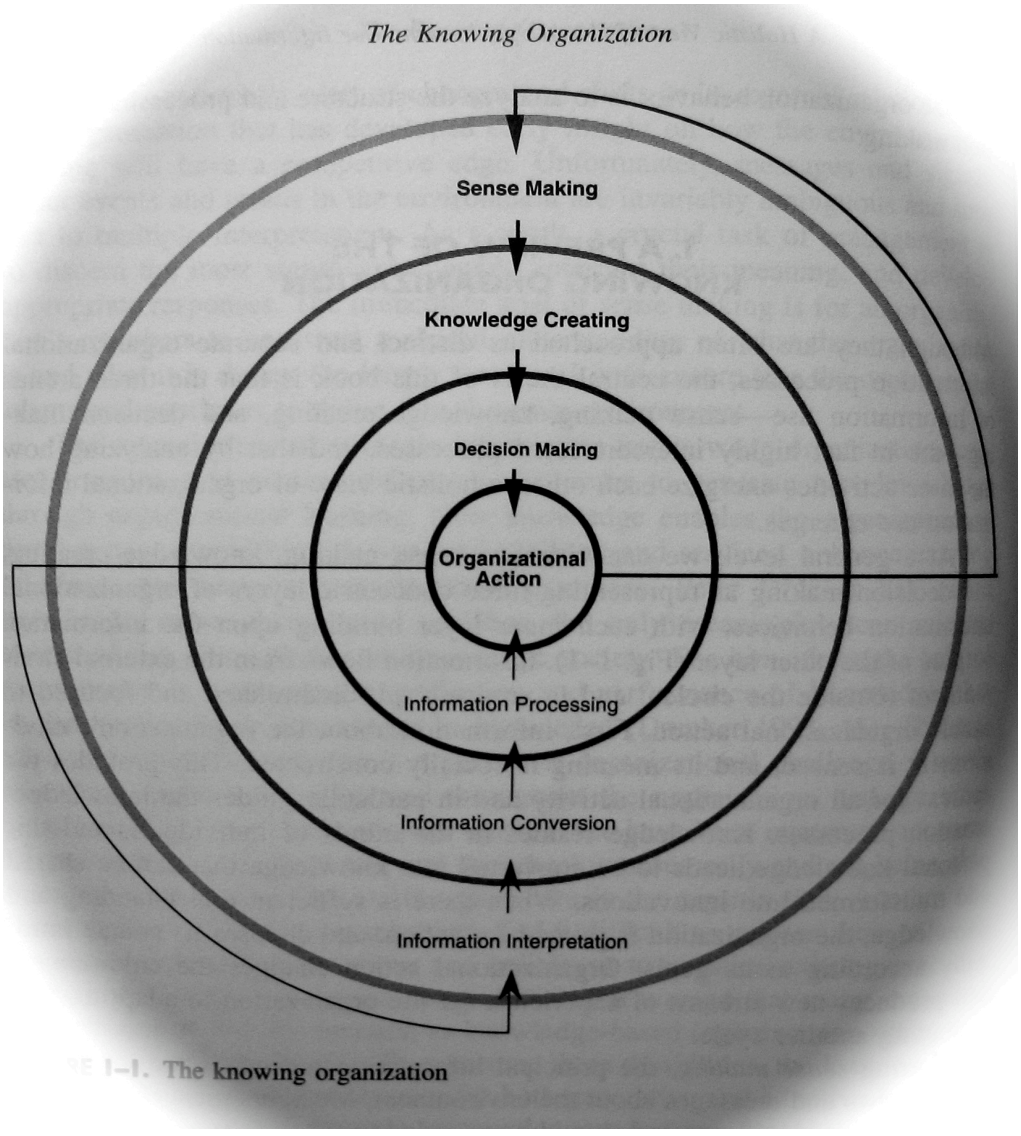

Figure 3-1: The Knowing Organisation, from (Choo '98), pp.4

According to Choo the central component of the knowing organization is the management of information and information processes. Indeed on these processes and using information in different ways and within different network exchange

individuals and group are able to make sense of complex situation, to build knowledge and to make decision towards certain goals. In the framework he proposes for the knowing organization sensemaking, knowledge creation and decision-making are linked "in a continuum of nested information activities that invigorate an organization with the information and knowledge to act intelligently" (Choo '98).

He focuses on the concept of information as the lever to generate knowledge that allows organization to act toward certain goals. He argues that the management of information resources, system and services is the mean to vitalize the knowing organization. The propulsive action of leveraging information to knowledge and knowledge to action is then enabled by sensemaking (Figure 3-1). Sensemaking received many different definitions in the literature (March and Olsen '76; Starbuck and Milliken '88; Thomas, Clark et al. '93). We will refer to the definition of the main character of sensemaking proposed by Weick, he define it as a key organizational process that is:

- Grounded in identity and construction
- Retrospective
- Enactive of sensible environments
- Social
- Ongoing
- Focusing on and by extracted cues
- Driven by plausibility rather than accuracy

(Weick '95)

In our approach we see planning as a sensemaking process which happens socially at the level of the 'emerging planning organization', and it expresses and explicates within planning conversations. As such planning follows the distinctive characters of sensemaking processes underlined by Weick. It is a social and always evolving activity of gathering and connecting cues in order to make sense of what is occurring. Sensemaking is by definition retrospective because individuals are able to reflect on events that already happened. The whole sensemaking nature is based on the assumption that we cannot know and even think about something before that this 'something' manifest in some way. Weick explains this concept by citing Wallas book The art of thinking in which he reports a discussion between a girl and a poet and the girl asks: "*How can I know what I think until I see what I say*?"(Wallas '26). Weick argues that in organizations people try to understand what's going on by talking with other people. Moreover they understand what other people thinks by listening to what they say. In this way they make sense of what they do. Thereby speaking is actually an act of expressing thoughts, and expressed words are the cues other people use in order to understand how other people think and act.

We push this concept in another direction, if I can know what I think just after I talk, and other people can know what other people think just listening to what they say, thereby conversations contain the cues that an individual need in order to understand its own and other people understandings and act in a certain situation. Therefore, in order to enable organizational sensemaking in the planning organization, the heart of the information that we are interested to trace is 'planning conversation'.

Analysing planning conversation individual and collective meaning can be understood or at least guessed and on this understanding or belief we can make sense of single and collective action within the organization. This is key for planning organizations because it allows a deep understanding of the social dynamics in play that affect planning decisions and actions.

Understanding planning processes as sensemaking processes also imply to see planning as a retrospective and enactive practice. Retrospective because at every stage of a planning process planners have to make sense of what happened up to that moment, which of course include not only what has been done (facts) of produced (design artefacts) but also what has been said. Moreover, if we are facing a participatory planning problem it is very likely that the amount of information to take in consideration is extensive and come from planning conversations which involve diverse and numerous stakeholders. Thereby, because these conversations already happened the individual needs to rely on memory traces of the event that are very likely inaccurate or at least partial. Thereby also the meaning they can extract from this memory traces to make sense of past event are by definition inaccurate and partial.

We could argue that this is already one good reason for supporting planning process with a process memory system to enable retrospective sensemaking. Nonetheless this is not our main argument. We should not forget that planning is a complex social practice in which striving toward accuracy can often turn out to be a utopia. As argued by Weick:

"I*n a equivocal, postmodern world, infused with the politics of interpretation and conflicting interests and inhabited by people with multiple shifting identities, an obsession with accuracy seems fruitless, and not of much practical help either*"

(Weick '95).

We sustain a pragmatic approach to planning which is concerned with the real contexts and conditions of lack of time and resources that planner faces during their practices. When the moment to act comes, planners need to have the means to choose plausible more then accurate decisions. Thereby a memory support system should not aim to represent all the amount of possible information of past events. On the contrary it should aim at supporting what Isenberg called the "thinking/acting cycle" (Isenberg '84). That is to say providing planners with a platform for reflecting by doing. The memory platform aims to be like a virtual and powerful notebook where planners take trace of what is or seems to be relevant and where they can go back, after the action, to reflect on the result of the action, thus drawing new insights and learning by experiences.

Thereby the point is not that remembering every single piece of planning conversations will allow planners to take the perfect decision. The point it enabling planners go back to what has been said when it happens or turn to be relevant. The process memory platform is like the evolving sensemaking memoire which supports planner to take plausible decisions and actions based on a more reliable and systematic memory trace of the process. It will never happen to this trace to bee complete and accurate but it can enhance sensemaking by helping in making better connections with already happened facts and conversations.

Another strong reason to motivate the need of such a memory platform stands in the consideration that planners in order to make a design decision need to use information strategically in order to make sense of complex situations and changing environments This implies blending new information with past information, knowledge and learning, adapting it to the ongoing context, while trying to make decisions and to take actions.

Van der Spek and Spijkervet have also discussed the concept of 'retrospection' (Spek and Spijkervet '97). In the KM framework they propose, retrospect and reflect together with other activities as conceptualization and action are key processes to create and manage knowledge in an organization. Even though their approach is oriented towards the enablement of a problem solving cycle, rather then toward the enablement of reflecting-interpreting-understanding cycles, they point out that retrospect is a key activity to evaluate results achieved and compare old and new situations and thereby this is a key activity to support a learning organization.

In order to enable this strategic use of information and to enable the process of blending between present and past information and knowledge while adapting them to the new emerging context planners needs an environment where:

- retrospection is supported in order to blend new information with past information, knowledge and learning
- the ongoing context is described with richness of details and in the respect of the multiple, relevant contexts that the planning problem manifests; that are the contexts to which organizations adapt their emerging "knowing" of the planning situation.

The memory platform provides planners with this environment by organizing structuring and representing information and knowledge according to those relevant contexts in which planning problems manifests. But how can we define these relevant contexts and how can we represent and organize information and knowledge in these contexts. Next section addresses this matter and in particular proposes a heuristic taxonomy of knowledge objects for organizing and representing planning information and knowledge.

3.4 Knowledge Taxonomy: Heuristic Categories of Knowledge for Participatory Planning

We used an Action Research Approach and in particular a Soft System Methodology in order to define and test a knowledge object and knowledge representation taxonomy along spiral learning cycle trough modelling and applying this knowledge taxonomy in real planning case studies.

The research methodology consists of four phases:

1. proposing a knowledge object taxonomy to represent and manage information and knowledge in planning
2. implementing a ICT system to support the ensilaged knowledge object taxonomy
3. applying and testing the knowledge taxonomy in more then one real participatory planning Process case studies

4. validating results by reflecting critically together with the stakeholders involved in the process by interviews, questionnaires and experts discussion groups.

The phases 2-4 will be discussed in the following of the thesis and in particular in the second and third part in which implementation and design (part 2) and case studies and evaluation results (part three) will be presented. In this section we focus on the first phase and we propose the knowledge object taxonomy. First of all it is important to define what we mean for knowledge objects' taxonomy. It is a categorization of five key dimensions in which planning information and knowledge will be structured and represented in the memory platform. These five dimensions are different 'focuses', different "prospective views" of the deliberation process. Also, each dimension is a key context of the deliberation process we want to analyze.

We start from the stance that "*multiple representations of a problem enable the user to view information in several context thus offering the potential to generate alternative approaches to a problem*"(Shiffer '93). Thereby the knowledge taxonomy defines what are the main alternative approaches through which we can tackle a planning problem; and the memory platform will support the organization and visualization of planning information and knowledge in these different dimensions. Each dimension in the memory platform represents different contextual dimensions in which the contents of the deliberation process can be represented and interpreted. Different views can trigger different insights and information on the same process.

The memory platform aims at supporting participatory planning and in particular it aims to represent deliberation in planning conversations. Thereby the knowledge objects that the memory platform will need to handle are mainly claims, which can be expressed in multimedia format such as text, video and audio files. Moreover planning conversation often involves conversation artefacts like maps, graphs, pictures, architectural drawing etc. All this information have been called knowledge objects and need to make associated and represented so that the deliberation process can be followed and understood by heterogeneous groups of stakeholders.

The five dimensions of the knowledge objects taxonomy are heuristic dimensions which have been defined by experimenting information modelling and representation in some real case study. As in a shallow grounded theory approach we have started by analysing video recording of planning meetings, our elements of analysis were the claims raised from the different stakeholders in the meeting. Every time we isolated a claim we had a broad question in mind: "What are the questions I need to answer to understand more about this claim?"

Then we started coding and grouping and group the claims according to the answers to this question.

I.e. I would need to know who raised this claim to understand why he is facing this problem. I would need to know what is the objective he is trying to accomplish. I would need to know to whom this person was addressing the question to understand why there was no answer to it. And so on.

Based on this analysis we recognized and defined the aspects that need to be addressed (the question that need to be answered) in order to interpret and

understand information and knowledge used and generated during a participatory planning process.

The following five testing categories have emerged directly from the data, and, of course, from our interpretation of the research question and of the analyzed phenomenon.

- *Social dimension:* Being planning conversations collaborative processes of deliberation a first constitutive dimension has been considered the social one: who are the actors and what they say?
- *Temporal dimension:* Furthermore, because the planning process is also a practical process of design, the time dimension has been considered key to contextualize contents to actions: when in the design process something has been said?
- *Spatial dimension:* Moreover planning issues are often spatial issues and claims often referred to spatial locations. Thereby the spatial dimension is considered constitutive to describe and contextualize spatial planning activities: What's the geographical area the claim refers to? How close/far this area is from the locations of our interest?
- *Conceptual/Argumentative Dimension*: The knowledge objects are mainly claims, knowledge claims or conversation artefacts, thereby the dialogical dimension is strictly necessary in order understand the meaning of certain claims, and to associate in a meaningful and consistent way the knowledge objects': thereby the conceptual dimension is considered constitutive to represent dialogues and deliberation: In which dialogical and argumentative content a statement has been raised? In which context of discussion?
- *Project Oriented dimension:* we need to understand the role the claim play within the participatory planning process and within the specific meeting goals in order to make sense of the claims in the broader picture of the whole project. Thereby we need to answer questions such as: is this claim one of our goals? Does it open problems/issues that needs to be addressed? Does it represent a resource to put in value? What doesn't imply in the design process? These are the answer that the contextualization to the project-oriented dimension should enable to answer.

This knowledge taxonomy has been used as the base on which to design the data collection framework to annotate and classify knowledge objects and then to represent them in the memory platform. The information architecture and the annotation scheme will be described in section 9.4. Moreover the five dimensional knowledge object taxonomy have been tested in two case studies (TG and SPP case studies) to represent the contents of the memory project. Results of the applications and evaluation of the memory system will follow in order to confirm or revise the knowledge taxonomy as in a soft system methodology approach. As we will see from the discussion of the results the knowledge taxonomy resulted consistent and effective and provides a rich and flexible hypermedia space to represent and manage information and knowledge gatherer in participatory planning practices.

3.5 Discussion

When dealing with participatory planning problems different decision makers, with different roles in government and society, held and use different knowledges but all relevant to tackle planning issues. A big challenge is to represent, store and manage this knowledge in a way this knowledge can be shared between all the stakeholders and can exert its relevance in a wider context of discussion (Demaid and Quintas '04).

Knowledge, or more precisely, different kinds of knowledge play a fundamental role in supporting planning processes. This can indeed be distilled from the literature (Innes and Booher '04) where authors are increasingly concerned about what kinds of knowledge are involved, which are the different sources of knowledge, which are the roles the play, etc. The management of knowledges in planning is thus a fundamental endeavour in planning which affects to an important extent the quality of the resulting plan.

Managing knowledges effectively is however a particularly challenging task on its own subject of research within disciplines such as Knowledge Management or Artificial Intelligence. In this chapter we tackled the management of knowledge within our concrete domain yet applying where applicable results coming from the areas previously mentioned. We provided a more precise and pragmatic definition of knowledge as compared to the various proposed, or simply implicitly adopted, within planning literature. We use this definition to propose an epistemological shift in planning towards a more knowledge driven practice. Finally, in the next chapters we support this transition by means of a process memory system aimed at supporting planners in the decision making process by capturing the complete life-cycle of the knowledges involved in a particular planning process.

4 Memory Practices in Participatory Planning

In this chapter we introduce the thesis hypothesis that a process memory platform can enable better knowledge management and transparent knowledge integration by tracing deliberation in participatory planning processes. In particular we address RQ1 and discuss the research motivation, explaining why and how a process memory platform can support participatory planning.

We will start with a literature review of two fields of interest that are Organizational memory and Argumentation theory. We explore an argumentation-based approach to decision rationale and argumentation structuring methodologies to represent, re-construct and document design-decisions steps.

From the literature review on organizational memory and argumentation theory we motivate and introduce the applied theory of memory we will refer to in the thesis. Memory is referred to as process-memory or project-memory; that is an artificial memory built trough capturing and mapping deliberation and argumentation within a planning practice.

Finally the reasons for the platform to be and the research rationale are discussed. We identify as the main objective addressing the need of stakeholders to reflect interpret and reason about information and knowledge produced in planning conversations. The process memory platform is defined as an environment to capture, structure represent and manage these knowledge in order to support deliberation, enable sensemaking and inform planning decision with a wider and diverse knowledge base collaboratively generated.

4.1 From Human to Organizational Memory Concept: The Relevance of Context

There are two main theories addressing the issue of defining a structure for human memory. The first one is the Associationism theory dated back to Aristotele. According to this theory, memory is consisting of a set of base elements like ideas, words or memory nodes connected in pair by naked or labelled links for semantic relations. The second theory is Guestalt or organizational psychology theory. According to this theory the base elements are not simple ideas; on the contrary the units of memory are variable and dependent on different perceptions. If several stimuli are perceived as a unit, they will be stored as unitary trace. These traces are connected in a hierarchical structure which gives shape to the memory structure.

Guestalt theory is then more suitable when information and materials to be recognized are meaningful per se and not easily decomposable in simple units. This theory suggests as the best way to remember facts or information is to structure them in a simple and stable organization. But this would contradict experimental results which show that subjects normally use to remember simple fragmented sentences.

If we assume that sentences are recalled in fragment (as associationist theory predict), how we have to treat the connections? Are these independent from the sentences traces?

Guestalt theory claims that connections cannot be considered independently because any memory structure is more then the sum or its parts, and it disclose emergent properties determined from the configuration and associations of these parts.

Experimentations evidences recommend the first theory for some reason and the second for some others. What seems clear is that sentences are remembered in different ways in different study conditions. So context seems to have a big influence in sentences mnemonic properties (Anderson '83). Role of context and environmental conditions in learning and memory practice has been studied from Lave and Wenger in their definition of situated learning (Lave and Wenger '91). For the "situated learning community: "Action is grounded in the concrete situation in which it occur", so context and environment are key for cognitive activities, and knowledge managed and used properly if not accounting on contextual conditions in which it is generated.

This is a base claim to the choices of our memory system methodology. We are looking for technologies able to draw a snapshot of the concrete situation in order to analyze it in details and to ground on this base better informed actions and decisions.

Nevertheless Anderson, Reder and Simon reviewed the central claims of situated learning with respect to education (Anderson, Greeno et al. '00), in their review of the concept they argue that this attention to context and practice can bring to misleading principles in learning theory. They show evidences supporting the advantages of symbolic representation and reasoning in knowledge transfer. Analogy of Symbols, mathematical relations (symbolic translation of relationship between entities) help in transferring knowledge from one domain of context to similar ones and this is the main potential for educational activities: knowledge acquisition (learning) and knowledge passing (teaching).

Although if we fully concur with (Anderson, Greeno et al. statement, and we agree that this can bring to misleading practices in the educational field, we consider that situated learning concepts have a relevant and diverse application in social practices like participatory planning is. In these practices the main objective is not learning but acting, in a way that is respectful and legitimate in the social context of application. Legitimacy, both to environment and people, moves the focus and the priority scale. Therefore we recognize that abstract representation is a useful help for knowledge management, nonetheless context representation and content preservation remain a core objective for a memory system supporting planning practices. In fact in these practices knowledge is legitimated from the social context where it generate and contents need to be shared in explicit and easy forms so that it can be easily explored and used form a large community of users. Not many users have the attitude and capability to access and understand abstract representation an this is, in our domain, already a good reason to explore representation that are appealing and intuitive for the community.

We adopt an "ecological approach" to memory as defined from Neisser (Neisser '94), we study how memory is used in the real world, assuming that principles and laws in the real world are different from the ones tested in laboratory; but on the other side we assume that a memory system supporting planning practices has to express representational and symbolic ability in structuring complex information types and supporting multiple knowledge structuring. Therefore, as we will discuss in the following the memory infrastructure is conceived to support this two perspectives of context preservation and knowledge abstraction.

4.2 Organizational Memory and Argumentation Theory

Research on Organizational Memory (OM) has a strong organizational focus. Thereby conceptual OM focus mostly refers to organization theory. We present a review of the literature on organizational memory from two different perspectives. The first one is theoretical oriented the second one is methodological and application oriented. Next figure shows how different sub-fields of research are organized by investigating the organizational memory field form the two perspectives (Figure 4-1).

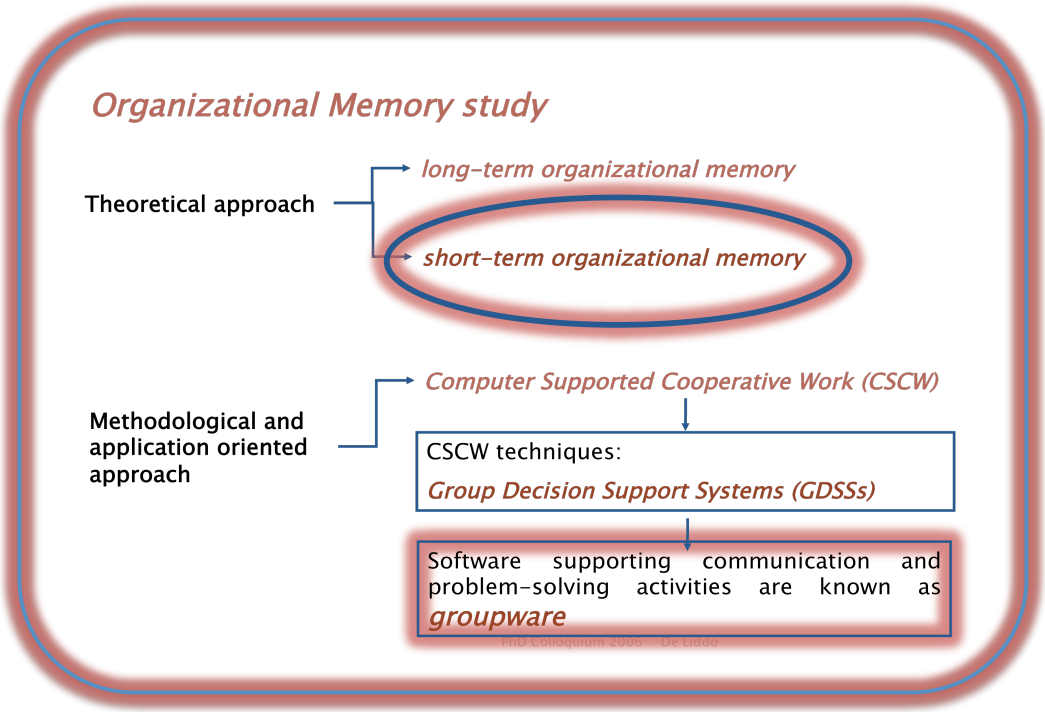

Figure 4-1: Organizational Memory Sub-Fields

From the theoretical perspective the distinction between long and short term memory has been investigated: long-term organizational memory refers to those structures and contents of Organizational Memory (OM) being stable like values, principles, cognitions shared throughout the organization; on the other hand short-term OM represents essentially an operational memory, is deeply related to a specific decision making process and is relevant for supporting the decision process

itself. Short-Term Memories (STM) are evolving entities supplying contents and knowledge to long-term memory throughout other memory steps. More specific reflections will be devoted to short-term memory creation and management, and to single agent knowledge and actions activated to reconstruct the history of a decision process (Conklin '01). STM is a place where experiences, thoughts, ideas and discussions develop long-term memory entities, a place where memories and old experiences are recalled to be processed and modified again. STM is the place where memory is put in action and becomes operative. In a CDMP this place could be defined as a collaborative environment were stakeholders communicate and interact, developing argumentative discourse around decision-making problems.

If we consider the methodological and application oriented focus we move to interdisciplinary area where Operation Research methods meet the challenges coming from the area of Computer Supported Cooperative Work (CSCW) and the exploitation of Word Wide Web (Karacapilidis and Pappis '97). New frontiers and tools offered by computer science and information technology research enable organizations, emerging all along CDM processes, to augment their memory and then their ability to accumulate, preserve and share the knowledge they generate in such processes. CSCW are computer-assisted communication and problem-solving activities carried out by a group of collaborating stakeholders. Software supporting these activities is known as groupware. The main objective and problems addressed by CSCW are multi-user communication, coordination of the group activities and support of a shared information space. The most common CSCW techniques are electronic mail, computer conferencing and Group Decision Support Systems (GDSSs). GDSSs are mostly mediating systems that support discussion and argumentations in groups, arisen within collaborative decision making processes. This CSCW technique is the one we explored in order to design a process memory platform that aims to take trace of the story of the planning process as process collaborative sensemaking process.

This platform will consist of several integrated groupware accomplishing different function and addressing different audits. The literature presents different definition of groupware tools; we will refer to the definition given by Peter and Trudy Johnson-Lenz (Johnson-Lenz '78) as "intentional group processes plus software to support them". Johnson-Lenz's definition stress the concept that groupware are not only tools they are actually strictly related to group process techniques that needs to be implemented in order the tool to be successfully used. Thereby groupware is at the same time software and a group process. However the main objective of groupware is helping people work together collectively. They can be synchronous groupware and asynchronous groupware, network distributed or stand alone groupware depending whether or not work group members collaborate in real time, and in the same location.

The second research field to investigate is indeed the Argumentation field. Argumentation theories consider argumentation from different points of views (philosophical, linguistic, rhetorical, psychological (Karacapilidis and Papadias '01) grouped in two main approaches: an informal and a formal approach to argumentation. Formal approach studies arguments as sets of sentences following syntactical and semantic meanings; informal approach put the accent on context, it views arguments as pragmatic and closely linked to their contingent objectives. We

refer to this second approach and the main focus is on implementation tools and methods of argumentation for different types of groups' interactions. These implementation tools and methods have been developed in the area of problem solving, and in particular in the second-generation design methods to face 'wicked problems' (Rittel and Webber '84). Wicked problems are ill-structured problems and have not correct, incorrect or given alternative solutions, these are problems that needs a process of argumentation to allows the problem situation to be explored and solution possibilities to be discussed by the stakeholders.

In the field of design artefacts, these problems are faced with argumentation-based approaches, and the need to take trace and reuse the knowledge generated in the collaborative processes of design is attributed to design rationale (Buckingham Shum '96). Wide ranges of argumentation-based approaches to design rationale have been proposed nowadays. The three main argumentation-based design rational methodologies are: IBIS (Issue-Based Information System) (Conklin and Begeman '88). QOC (Question Options Criteria) (Allan, Richard et al. '96) and DRL (Decision Representation Language) (Lee and Lai K.Y. '96). These are all models to represent the rationale of reasoning in a decision making process. Several decision rationale support systems (Ramesh and Sengupta '95) have been based on these three models in order to assist user in interpreting and reasoning about knowledge during a discourse. For instance Quest Map is based on gIBIS hypertext tool and captures and structures (by meaningful relationships) the key issue during a meeting. Other examples are JANUS, SEPIA, REMAP and SYBIL (for further descriptions see (Karacapilidis and Papadias '01).

We propose to transpose methods and tools conceived for design rationale to the contest of wicked problems in the participatory planning domain. Planning is the domain in which wicked problem have been defined for the first time by Rittel and Webber (Rittel and Webber '84). Rittel and Webber argue that it is not possible to define predefined scientific bases to confront problems of social policy because these problems are 'wicked' problems. They give the meaning of 'planning problems as wicked problems' for the first time in the 70tyes. In their article 'Dilemmas in a General theory of Planning' they describe the character of these problems stressing the following points:

- There is no definitive formulation of a wicked problem
- Wicked problems have no stopping rule
- Solutions to wicked problems are not true-or-false, but good-or-bad
- There is no immediate and no ultimate test of a solution to a wicked problem
- Every solution to a wicked problem is a "one-shot operation"; because there is no opportunity to learn by trial-and-error, every attempt counts significantly
- Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan
- Every wicked problem is essentially unique
- Every wicked problem can be considered to be a symptom of another problem

Opposite to "tame" problems normally addressed by science wicked problems are ill-structured problems that have not correct, incorrect or given alternative solutions. They can never be exhaustively formulated and there are never enough information or criteria to reach 'sufficient understanding' of the problem thereby the problem it is never solved. It just happened that at some point for opportunistic reason a solution is taken (because the time is short, because the resources are limited, because an action need to be scheduled according to certain rules, because you like one solution more then another…etc). Solution to wicked problem are cannot be verified because they have long chain of consequences spanning on space, people, and time thereby they cannot be properly appreciate before they really happen. At the same time every solution leaves indelible traces that cannot be undone. This implies that trial do not really exist in the planning domain, each action effect the problem setting and generates new wicked problems to address in always novel ways.

Thereby a wicked problem will be never described in all possible ways, a planner will never be able to explore all the solution space of a wicked problem because this space is an hyperspace of infinite dimensions that change not only with the problem itself but also with the interpretation that that problem Planners decide to give. For all these reasons there also many way to represent a wicked problem and the differences between two representations can be explained in many different way with respect to the planner worldview, and this affects the nature of the problem resolution.

The theoretical dilemma of wicked problem is furthermore complicated by the social dilemmas that planners confront with in the post-industrial society. The rising of pluralism has provoked problem of equity and definition of a societal goodness thereby planners do not have any clear theory or method to refer to in order to inform their choices and to valuate the effects of these choices. This dilemma and describe the main (Rittel and Webber '73)

Rittel and Webber do not initially come out with a theory to address wicked problems. Later on the research on wicked problems leaded to the development of the so-called 'Second Generation Design Methods'. Cording to these methods, wicked problems needs a process of argumentation to allows the problem situation to be explored and solution possibilities to be discussed by several stakeholders. The only way to face a wicked problem is by a process of deliberation and argumentation involving several stakeholders involved in the planning process.

Deliberation is the ribbon that ties our study in the organizational memory field and in particular in the field of groupware with the field of argumentation theory and second generation of design methods. We aim at the design and implementation of a process memory platform which aims at capturing deliberation in participatory planning practices, thus supporting STM activities of using and reflecting on information and knowledge used and generated in planning conversations. In the following chapters we will discuss a process memory platform consisting of three complementary groupware. Each groupware will be described in chapter 6 together with the operations available in the system and the activities that the users of the system can perform.

4.3 Argumentation Tracing for Organizational Memory Structuring

Looking at the planning domain, if we understand plans as technical description of future visions of public spaces and patterns of development, these visions have to be developed in collaborative environments in which discussion dynamics and negotiation of decision spaces continuously take place in a wide stakeholders arena. In this arena stakeholders express their position and communicate between them by argumentative dialogs. Argumentation is the common form of practical reasoning between stakeholders and its role is to explain and explicit informal knowledge developed during CDMP (Tweed '98). Therefore argumentation has a great potential role in supporting self and group reflection, it is an effective sensor for the process monitoring and it is significant as practical way to reason about issues and to reach decisions. In this sense argumentations models can be considered valuable tools for process memory exploration since they provide the structure for the user to explore and interpret the contents of that memory.

During decision-making processes in collaborative environments, people discuss and interact between them. They build (starting from their personal stories and experiences) community narratives, that are common stories which sediment and structure the process memory along the time. This organizational process memory is useful not only in order to improve the individual understanding of decision processes, but it is also the repository where communities "wisdom" (successes and failures story becoming collective knowledge) is preserved.

Group of stakeholders involved in a planning process can be conceived as ephemeral emerging organizations, which build organizational memory all along the decision-making process. Such organizational process memory can be a valuable tool of capturing, organizing and reusing knowledge produced in such collaborative decision making processes, and it can amplify knowledge organizations potentials. In this sense an organizational memory platform has not only the role to preserve and accumulate knowledge experiences but also to support and improve knowledge sharing.

This is particularly relevant for collaborative environments like the participatory planning environments are. In fact only if an individual is ready to collaborate and share his ability, his expertise is useful for the organization. Interaction occurs in the moment in which our personal knowledge is put in the net and than it is put in value. That is the reason why tools and systems of sharing knowledge are virtuous systems for learning. In this sense if we support participatory planning with an organizational memory support system we characterize and encourage spaces for learning and understanding.

Therefore the need to define organizational memory tools starts form the need to assist management and reuse of knowledge. Creation of structured and accessible information and knowledge about the planning process aims at: i. augmenting the group awareness of DMP, ii. recognizing mistakes and opportunities learning from the past, iii. understanding the reasons that bring to decisions.

For these purposes it is necessary to study in depth new tools to support the representation, exploration and use of decision rationale knowledge, trying to

understand how these tools can support the infrastructure of short term memory (process memory) and how to make these memories operatives for collaborative decision-making processes.

4.4 Why an Organizational Memory (OM) Support System

OM studies refer to issues concerning the way organizations uses and maintain knowledge. The need to talk and explore the OM concept in participatory planning experiences starts from the stance to consider information and knowledge (used and produced in these processes) no as passive records to be stored in a database but as dynamic contents living and changing along the time and with the organization evolutions.

Given this understanding, we will consider organizational memory as an 'always novel interpretation of the common history of a community or organization'(Bannon and Kutti '02). This conceptualization links memory to interpretation.

The memory of the organization is related to how people from that organization remember that history, not only as individuals, which determine how this history affect people thoughts and behaviours, but also as a group, because how the group 'declare' to remember that history affects organizational decisions and lines of development.

Interpreting memory in this way means that in order to support it, it is important not only capturing and storing that history but also making it accessible for further and continuous interpretation and exploration along the time and by all the member of that organization that are involved in building that memory day by day.

In order the memory to be accessible to different stakeholders with heterogeneous roles, backgrounds, and objectives and level of education, it has to be represented in different ways for different users. The same memory contents need to be represented and expressed in different languages, focusing on different aspects and stressing different visual communication media.

Starting from these reflections, research effort have been devoted to design an Organizational Memory system that allow: i. to record and assist the knowledge generation and management expressed in several media: graphs, images, texts, video, audio, etc; ii. to keep trace of the history of decision, to trace the contents evolution and changes along the process.

Such organizational memory system would enable the organization to extract from the history specific or new contents which are, or become during the process, "the focus of discussions and actions", thus making the organizational memory a changing construct which live and evolve with the interpretation of the information and knowledge captured and stored in the memory system (Loren, Peter et al. '93).

4.5 Organizational Memory (OM): The approach

"Since an organization is not an organism the only memory it possesses, in the proper sense of the term, is the collective memory of its participants. This is insufficient for organization purposes,

first, because what is in one man's mind is not necessarily available to other members of the organization, and, second, because when an individual leaves an organization the organization loses that part of its 'memory'. Hence organizations, to a far greater extent than individuals, need artificial 'memories.'"

(Simon 1957: 166)

This is an extract from Herbert Simon's Administrative Behavior, 2nd Edition (1957, originally written in 1945). Simon refers the concept of memory of an organization to the collective memory of their participants. This is the natural memory an organization is provided by; this collective memory is insufficient for origination purposes that's why the need of artificial memories in the organizational field. If we enlarge the concept to participatory planning environments we could paraphrase his contents as follows:

Since a group is constituted by several individuals the only memory it can express is the collective memory it posses. We consider collective memory a memory of shared experiences and knowledge that is very different from the sum of individuals' memory. However we do not intend to debate here the definition of collective memory (for discussion on this topic see (Walsh and Ungson '91; Buckingham Shum '97), what is relevant from an organizational point of view is the memory of the planning process. This memory, that we will call indistinctly process or project memory, is more then the subjects' memory, and more of a collective memory. Process memory is composed of:

- a memory of people's interactions and claims,
- a memory of design events,
- a memory of decisions taken,
- a memory of argumentative chains of reasoning which brought to that decisions.

To say it differently it is the memory of the design process together with the all knowledge and information relevant to make sense of the process, of its history and its rationale.

Thereby we interpret the concept of memory focusing on his organizational *aims*. As in H. Simon's AI approach, we consider the need for documents, databases and repositories where information and knowledge may be retained and reused from all the member of the organization. Thereby the approach we propose in the thesis bases on Simon's engineering point of view on memory, while at the same time merging it with the active and constructive aspect of 'remembering' as introduced from Bannon and Kuutti (Bannon and Kuutti 96).

Remembering is a contextual human activity driven by specific aims, in specific moments and settings and developed by specific actors; remembering is the act of using memory by subjects and organizations. This act is normally driven from specific reasons and in a specific organizational context. If on one hand Simon's approach suggests to face the problem of organizational memory by providing organized information, databases and repositories, on the other hand Bannon and Kuutti emphasize the attention to human actors and real organization settings as the subjects of the remembering act, which is often neglected in some ICT approach to organizational memory.

We propose an approach which integrate the too views by supporting a parallel reasoning between AI (Artificial Intelligence) approaches and theories developed in the organizational field. We define a conceptual model of memory system that is more then a knowledge repository. It is an environment in which all the main memory functionalities can be performed by individuals but with the support of an artificial environment which enables to extend individual abilities of remembering, reflecting retrospectively and understanding.

4.6 Discussion: The Thesis Rationale

In this chapter we discussed how the three research fields of organizational memory, argumentation theory and participatory planning research merge in the rationale of the thesis. The following image (Figure 4-2) gives a summary of the concepts explored in the chapters.

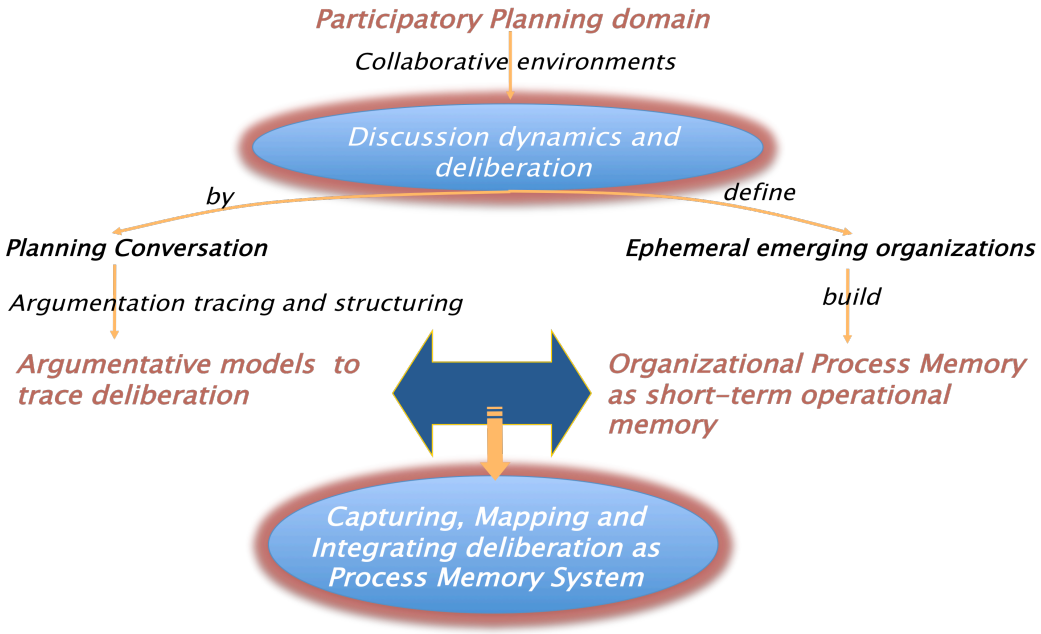

Figure 4-2: Research Project Rationale and Investigated Fields

As discussed in section 2.2 we look at planning processes as collaborative processes of making sense together trough planning conversations. Planning problems are wicked problems which need processes of conversation and deliberation between different stakeholders and groups in order the problem to be understood. Addressing a wicked problem means exploring the problem setting going through a process of understanding. It is our considered opinion that planning conversations are the 'space' and the 'medium' in which planning issues are addressed, understandings happen and planning decisions generate. These are the moments in which the reasons and conditions for a planning decision to occur are set up. Thereby planning conversations sign the moments that need to be tracked in order to understand the planning process history. Planning conversations are the memory objects of a Short Term Memory (STM) for participatory planning processes. They delineate the thread of information and interaction between the stakeholders and through which the planning process developed. As short-term memory objects

planning conversations are normally highly context dependent. Study in the organizational memory field shows that STM is the place where memory is put in action and becomes operative (Walsh and Ungson '91; Conklin '01; Borri, Celino et al. '06). Thereby information and knowledge used and generated within planning conversations have a high operational value and they can help putting knowledge in context and understanding links between facts and actions. We investigate new technologies to structure and represent short-term memory thus enabling reflection and understanding of the planning problem setting.

The literature on argumentation theory shows that particular argumentation models have been specifically designed and tested in the computer science, corporate and policy making fields in order to structure conversations and on-line off-line discussions about software design and policy matters (Conklin and Begeman '88; Renton and Macintosh '07). Also, some contributions are specifically devoted to building new form of policy memories oriented to perform informed deliberation processes. (Elliman, Macintosh et al. '06; Renton and Macintosh '07). These contributions prove the advantages to use argument visualization tools to structuring and represent deliberations in different fields. Nonetheless no specific applications to the planning field are reported in the literature. We propose the development of a memory platform that is first of all a tool to work and reflect on planning issues.

II Process Memory Platform

5 A Process Memory Platform for Participatory Planning

In the previous chapter we defined the approach to organizational memory that we chose in the thesis. In this chapter we motivate the need of a process memory system to support collaborative panning processes and planning organizations. We start describing the planning organizational environment and the nature of the planning organizations which emerge around participatory planning processes. Then we motivate the need and envisage the potential uses and benefit of a memory system supporting planning organizations. We partially address RQ2 (that will be also tackled in chapter 6) by proposing a conceptual model of process memory for participatory planning. Moreover we address some theoretical issues related to the memory objects granularity, to the role played by the knowledge manager and to the activities to be performed in the use of the memory platform.

5.1 The Planning Organizational Environment

These are the three levels in which we imagine to group the organizations involved in a participatory planning process. This simplification (which of course doesn't presume to be general or comprehensive) helps visualizing and then reasoning about the three main audits to which a planning problem should be addressed. Each organizational level partially shares organizational rules and common objectives within the process, but still internally conserve several differences in needs, aims and peculiar objectives. In order to build this three-levels classification we used the following principle: organizations fall in one of the level if they share same rights and duties to accomplish within the urban planning process.

In Figure 5-1 we show the three organizational levels (Community, planning project and institutions level) and the several interactions that can occur in a prototypical urban planning practice at three different organizational levels.

The first organizational level includes government and institutions. Organizations included in this group are committed to define rules and schedule of the process and to guarantee the legal and political constraints. This is also the decisional level, in which final decisions about actions to implement are taken.

The second level is the technical expertise level. At this organizational level different groups of experts interact and contribute to the process mainly managing the project, exploring technical feasibility, defining planning alternatives and then passing them to the decisional level.

The third level is the community level. The participatory burn of planning focuses actually on the ideal contributions of community to the planning process. A Main contribution of this organizational level is local knowledge about community needs and resources. This organizational level is less structured and fragmented, but nonetheless it have a key role in the real implementation of planning actions; so that the better the planning process is communicated and negotiated with the community the higher is the effectiveness of planning actions on territory and

society. Literature on the topic claims for the need of community involvement in the planning practice (Healey '97; Forester '99; Innes and Booher '04) but this continue to show big challenges and obstacle to its concrete effectiveness in practice (Irwin '95; Hanna '00).

How can a process memory system support our goal to enhance knowledge management in participatory planning practices?

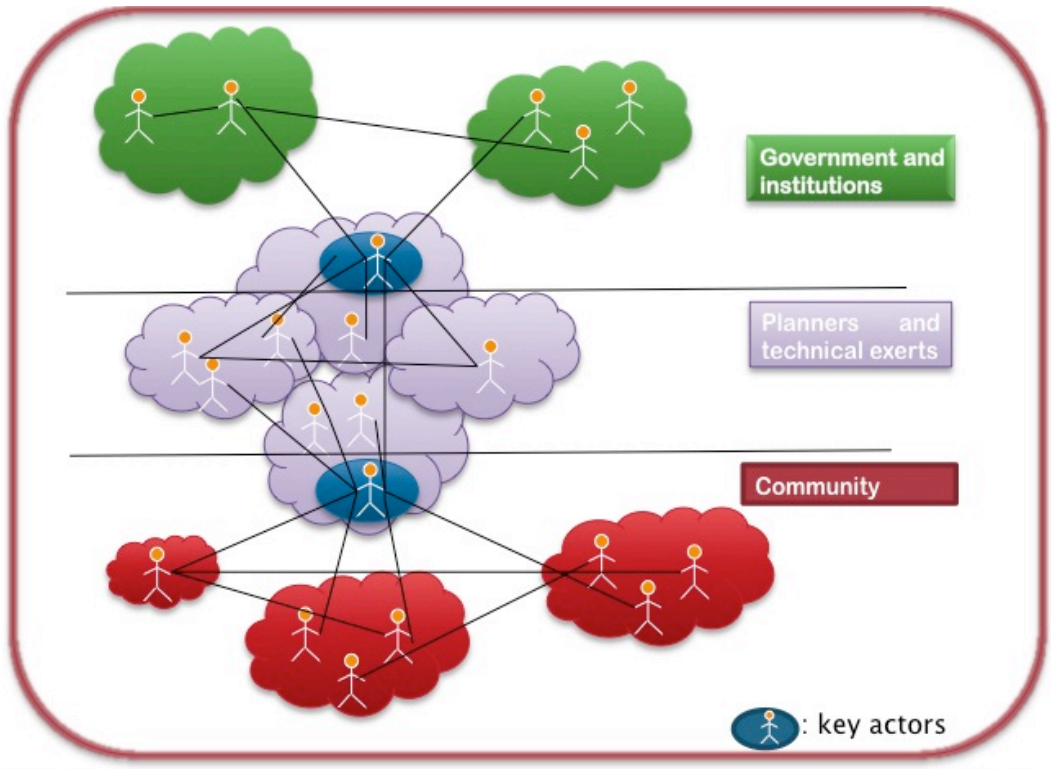

Figure 5-1: Planning Organizational Levels

Different interfaces are suitable for different involved subjects: housewife of a small neighbourhood, and the major of the city will be comfortable with different knowledge typology and visualization means, so the aim is to represent and disclose the same knowledge in different forms for different interested audits.

The process memory system should provide an environment to exploit different knowledge representations and mapping techniques stressing several knowledge media and linking multi-media objects in different representation spaces (hyper linking object in different context). The process memory system should provide a hypermedia environment is needed where exploration of contents and process is immediate, clear and easy to explore by all the planning organizations involved at the three organizational levels.

5.2 The Emerging Planning Organizations

When a planner or a planning team is called to design a plan or a planning programme they firstly defines one or more project teams to involve in the project, according to the project scale and topic (i.e. mobility, hydro-geologic, architecture, history of development, economic, citizen-participation teams etc). With them the

planning team discuses main design issues. At this early design stage objectives and design strategies are pointed out and a first distribution of roles and tasks starts to emerge. Several organizations start being involved in project. Each people involved in the project teams have normally an organization of origin (universities, design offices, institutions etc). Additionally other institutional and non-institutional organizations can be involved to discuss the strategic line of project development, including rules, schedules, partnerships etc. We can say that this first phase is the one in which the project is discussed in its overall objectives and constraints, following the indications of the planning regulation in force and of the project call for bid. Indeed, the public announcement normally defines resources, overall goals and constraints the planning project should accomplish.

A new organization starts to take form, which includes project members and indirectly their organizations of origin. The new emerging organization is a fluid organization: participants enter and leave the organization continuously during the whole design process; their roles change and evolve together with the changing deign contexts and needs. Nonetheless, this fluid organization has a proper and self-defined structure.

Every project team has generally a representative that can be entrusted both from the group (the person chorally recognized as expert or who has a role of leader in the organization) and by the project coordinator (for expertise or position in the organization). Each representative is in charge of communicating the actions of the design team to the representatives of the other teams and to the coordinator. This happens normally during meetings in the course of the design process that are planned to coordinate the actions between different teams and to check the project consistency with schedules, objectives and constraints. Furthermore the project coordinator is in charge of coordinating the teams and communicating to the institutional component the project progresses, salient events, emerging problems and achieved goals. The institutional component of the organization represents both the project customer and the decisional component of the project.

Moreover, above the project teams there is usually one that is in charge of the consultation process with the local community. The representative of this team exerts a key role in the organizational structure because is in charge of communicating contents and results of the consultation process to the other team members and to the other project team representative.

This organization structure is just one of the possible occurring organizational structure developed around the planning project. Many alternatives configuration are possible key actors cache in the process for opportunistic reasons. In example, let's imagine that one member of the environmental-risk team happen to be a citizen of the small neighbourhood that the planning project pertains. He then started to exert a key role in the citizen-participation team. Inhabitants of the neighbourhood trust one of their countryman's and this enhance the community willing to engage with the project and the effectiveness of participatory planning process. These opportunistic situations happen continuously during the project development and cause continuous reconfigurations of project members' roles in the emerging planning organization.

Nonetheless in Figure 5-2: Planning Organizational Environment and Emerging Planning Organization we report the more stable organizational framework on top of which the new configurations can take shape. The emerging organizations are constructed around the planning process activities and the interactions and exchanges that these activated activate in the planning organization settings between organizations members.

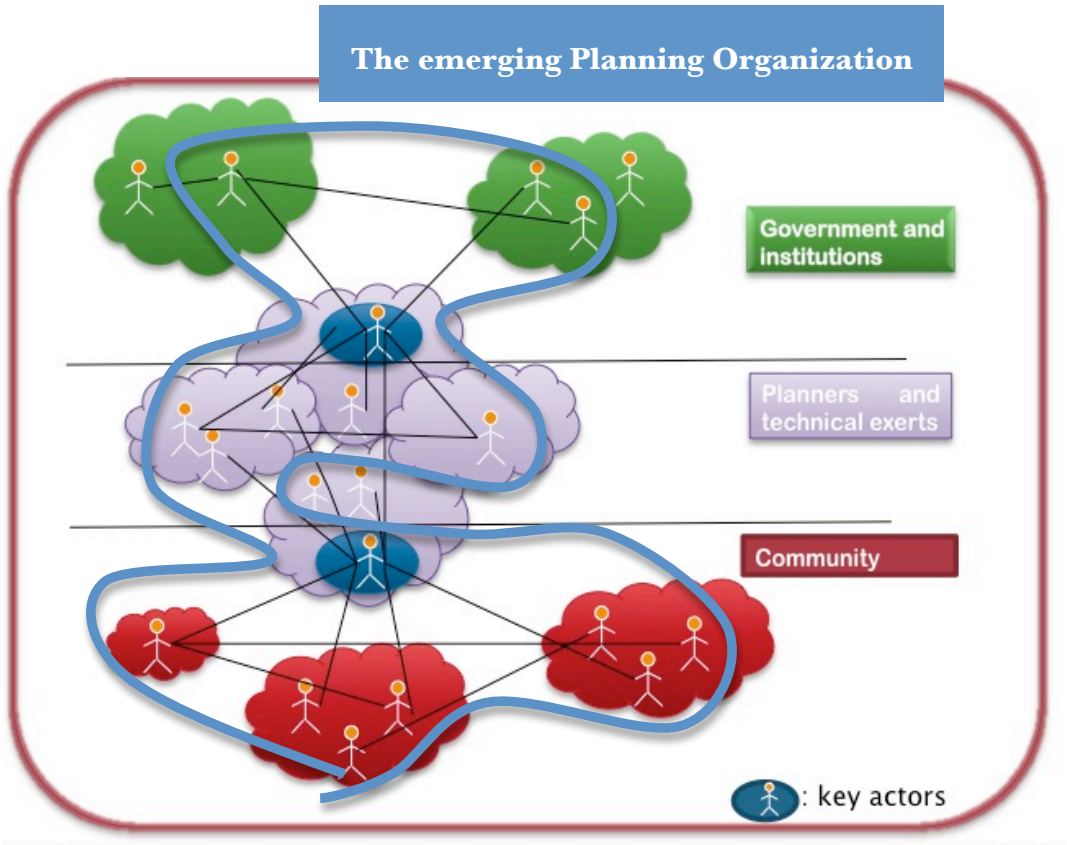

Figure 5-2: Planning Organizational Environment and Emerging Planning Organization

We take an interactional view of planning as defined by Dant and Francis: in which "planning is an activity in which people attempt to organize their knowledge in relation to some collective practical tasks"(Dant and Francis '98). We define the emerging planning organization in terms of information and knowledge exchange between stakeholders. The organizations boundaries are defined by the interpolation of the connections between the stakeholders involved in the planning process. Thereby it is a mirror of the information and knowledge networks which activate and generate at social level when a planning process develop. This information and knowledge network evolves along the planning process and follows the information exchange and knowledge evolution.

5.3 Organizational Memory or Collaborative-Process Memory?

As we discussed in the previous sections in participatory planning processes it is not so easy to talk about "organizational" memory because it is difficult to refer as an organization to the heterogeneous groups of stakeholders involved in these processes. In the literature they are referred to as "ephemeral organizations" to express that they are ill structured and evolving (Celino and Concilio 2004).

We described the planning organizational environment in which the planning process develops. Moreover we described the process through which a planning organization emerges with the project development. We proposed an information and knowledge-oriented approach to define planning organizations boundaries as the interpolation of information and knowledge exchange between planning stakeholders.

Nevertheless it is difficult to assign to those groups the key characteristics that are attributed to organizations in the organizational field. According to the principles which guide our definitions of planning organization, it is more like a community emerged during the planning practices but, unlike Communities of Practices, it is composed of stakeholders that not necessarily (and very likely do not) share same objectives and interests. What bind together this community is the planning process itself and the information and knowledge works that the stakeholders need to perform in order to participate, decide and act in the planning process.

That's why we will refer in the thesis to the memory at stake as Process- Memory. More precisely we should call it Collaborative-Process Memory because it is collaborative generated through information and knowledge interaction. Thereby when talking about OM, we will be referring to these specific emerging organizations and to the memory of the process which shapes the form and the development of these organizations. The process memory system will be conceived to support the collaborative-process memory and within this process will support the construction of memory of the emerging planning organization.

In the following we propose a process model of how to trace knowledge generation in collaborative-decision-making process. Main goal of the tracing is the managing and use of information and knowledge both during the process and after in new similar contexts or for facing similar problems. Moreover we put the accent on process and on procedural activities to be implemented to trace and manage knowledge generated around planning practices.

5.4 The Process Memory System Model

As discussed in the previous section we aim at designing a process memory system to support the activities of the emerging planning organization. These activities address different objectives at three different organisational levels, which have been described section 5.1. We now propose a conceptual model of the process memory which describe the process activities and the information and knowledge objects that the process memory system intend to support by organizing them in three

memory level. Moreover the process memory system will support the planning process memory at these three memory levels.

Each memory level refers to different memory objects types which depend on the nature of the "received content" to record and retain in memory (Smoliar '06). For received content we mean the multimedia data which needs to be stored in the memory system, it can be an image, a statements, a situation, a fact a chunk of conversation, etc. Each memory object corresponds to a peculiar granularity, which affects the level of details to record and the methods and tools to take trace of the memory objects.

The memory system is consisting of three levels (Figure 5-3)

1. The discourse level
2. The decisions level
3. The process level

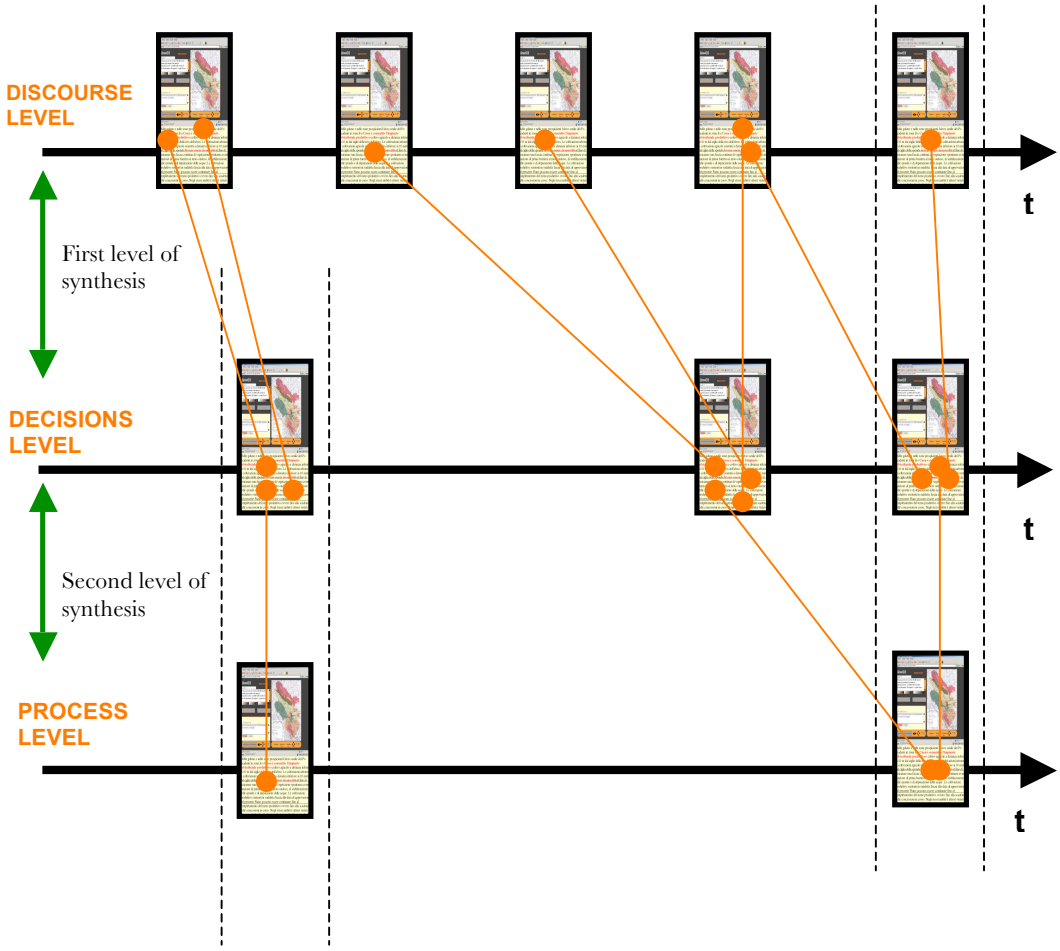

Figure 5-3: Memory System Levels: Three Interfaces of Knowledge Contents Exploration

The discourse level is the level of higher granularity, this is the level at which all meeting contents and planning conversation details are stored. All available information (notes, graphs, videos, mails, phone call records, documents, reports,

maps etc) are collected event by event, meeting by meeting, and structured in five overall categories (semantic axis) according to their: temporal, spatial, social, conceptual and causal dimensions.

Memory at this level can be explored following contents organized event by event (meeting by meeting) by following the discourse rationale of each meeting. Each discussion will be represented in the process memory system with an IBIS model of discourse representation.

The Decision level is the level of decisions rationale. Here all decisions are stored as emerged in the process by focusing on the design argumentation threat. The memory platform at this level should follow the decisional path that the planning team decided to follow, building and explaining causal links from preliminary assumptions to final decisions. This is the level were micro and macro decision are represented together with their argumentation rationale. The planning team in building and disclosing the decision rationale should build its arguments basing on the discourse level. To say it differently the discourse level should be the information and knowledge base on which the decision level founds.

The process level is the one in which decisions and events are contextualized to the process phases. Political, legal and time-schedule constraints are considered and they shape the boundaries of the process. Within these boundaries main decisions are organized and represented according to their higher strategic objectives, showing how decisions absolve to these objectives.

Every memory level has a decreasing level of memory objects granularity. So every changing in granularity implies an element of discretionarily, that is the grade of knowledge synthesis the knowledge manager is entrusted to apply. The following section addresses this topic, showing, explaining the key role of knowledge manager as the person who decide how and what to forget and remember between and within memory levels.

5.5 Role of Knowledge Manager

Memory building through the memory system is first of all a reflective practice. During this practices knowledge managers apply a contents tracing methodology, which brings him to deeply reflect on information and knowledge objects to memorize. The knowledge manager performs a set of actions like: naming, classifying, binding with pre existent objects (memory objects), and then rebuilding causal links between facts and events, disclosing reasons behind facts, events or decisions, summarizing and communicating results at spaced intervals etc.

These actions imply high discretionary grade of interpretation, deliberation and decision from the KM side. This interpretation grade should be recognized and not only accepted as unavoidable but also emphasize as necessary. Unavoidable because each activity performed for the memory building practice need complex intellectual skills and abilities. Moreover we are not looking for un intelligent system which substitute individuals in these tasks, we are rather looking for organizational practices which can support better informed and aware decisions to be taken from real actors holding a stake in the process, at the particular moment and in the

specific social, environmental and decisional context. The knowledge manager is undoubtedly one of these key actors.

Remembering and forgetting information and knowledge when doing a plan are social responsibilities at all levels (community, technical and political). Planners in charge of KM tasks have to recognize, accept that among their tasks there is the one of interpreting, deliberating and deciding what to all the stakeholders will be able to remember and what to forget about the planning process. Geoffrey C. Bowker and Susan Leigh Star in their book "Sorting Things Out: Classification and Its Consequences" (Bowker and Leigh Star '99) argue that classifying is the best way to systematically forget. In the memory building practice, classification of information and knowledge and reasoning about them is not automatic but is supervised from the KM that has the responsibility to be reliable and accountable for his work.

Reasoning doesn't follow pre-defined laws but is open to distributed cognitions and interpretation from the users; they can freely explore the contents, making sense of them in a personal and creative way. The memory system aims to inform creative reading of process histories suggesting new possible solutions to present issues: Learning from the past in a creative way.

Knowledge manager applying this memory building activities is stressing both his personal memory properties and memory properties of the system in order to build an artefact which is the memory of the process, that is to say an artefact which contains the memory of the process, support reflections through exploring the past, understanding the present, and supporting creative insights for future actions.

5.6 The Problem of Memory Granularity

The memory support system is conceived as a complex and rapidly growing dynamic knowledge repository. Information and knowledge recorded are rapidly growing along the planning process and an enormous amount of details at different grains are stored in the system.

It is obviously clear that mastery of all the ideas, contents and details is not expected. So the question is how many details have to be included to reach the objective?

Establishing an appropriate granularity for memory objects is a main issue in memory system and process design. Cognitive psychology theory on memory shows controversial arguments which could push for the choice of reducing details in favour of summarized contents.

Reder and Anderson (Reder and Anderson '80) wrote about this topic and in particular about the advantages of summaries in retaining central ideas (in particular the central ideas of a passage). They present experimental results where, surprisingly, details do not help memory for the main point of a text. The subjects infect learn information better when they read summary, compared to the full detailed version of the same information. This evidence is true both for a short-term line and after 1 week, 6 month and one year. Thus, reading summaries show long-term memory traces.

Reder and Anderson also tested the memory skills expressed from the subjects: i. to direct questions about specific contents, ii. to inferential reason about that contents and iii. to the learning of new material. Also in this case, summaries showed comparative advantages. Even answering speed increases when information had been learned in summary form.

Summary advantages are due to two grade reasons: i. because summary allow the subject to read main points at spaced intervals, ii. Summaries remove details that could distract the subject from the main points to focus (Reder and Anderson '82). Summaries demonstrate to be more effective then text in supporting memory of facts and information, they show advantages in remembering information both for giving answer and for doing inferences about text contents (Reder and Anderson '80). This founding is important because point that details hinder and delay acquiring of key points, so they hurt memory of central ideas.

Therefore even when recognizing parallel advantages of details keeping we have to consider that they have a cost and this cost have to be weighted in respect of the aims and possible benefits.

This problem will be discussed again in the final chapter when we will discuss the results of the memory platform implementation and evaluation (see sections 11.5.4, 11.9.3 and 11.9.5). The process memory model proposed in section 5.4 suggest that the process memory system should support different level of abstraction vs. contextualization. The discourse level is the level of higher granularity of the memory objects because many aspects and details need to be considered in order to understand the reasons and the evolution of the planning discourse. Thereby at that level the process memory system should provide the users with the possibility to deepen in the discourse analysis. As discussed in section 4.6, particular attention will be paid in the following of the thesis in the support of this level of capturing and exploration of the process memory. Nonetheless we aim at designing a process memory system that starting from the discourse level assist the exploration, representation and understanding of the other memory level (decision and process level). We will also give a practical example of how the discourse level can be used as the founding for a better understanding of the other two levels of abstraction of the memory model that are the decision rationale level and the process level (see section 9.7.1).

5.7 Memory Building Practice and System Exploration

When we think about the memory platform design we have to think about: who is this platform for? Who is going to use it and why?

The memory platform is a computer environment in which information and knowledge about a planning process are structured and represented in a certain way. This is conceived first of all as a tool for planners. The planning team is in charge of managing the information and knowledge contents of the memory platform and it is the one entrusted for the activities of information and knowledge capturing, structuring and representation. We will refer to these activities as memory building activities.

Ones that that the memory building activities have been performed the tool can then be used and explored from a wider and heterogeneous group of users, which include the three organizational layers described before (community, expert planners and institutions). We need then to distinguish between:

1) What to gain from memory building practice, and
2) What to gain from system exploration.

When thinking about memory building practice we refer to the reflective practice performed from the KM during the memory building activities. KM is the first user of the system and, being him a member of the planning team, this practice is conceived to inform and communicate to the project team about project evolution along the process, monitoring project phases, giving a support to check actions effectiveness and work in progress, evaluating in progress results and suggesting revision of strategies, activities, organizations of work and resources. Many are the possible benefits of the memory system can offer to the planning team if applied in the on going phase. Nonetheless as we will discuss in the testing phase there are also limits in applying such a practice 'on the fly,' in the normal conditions of scarce time and human resources in which more often all projects pour.

The second point concerns what we gain from system exploration. The main goal of system exploration is to inform creative reading of process histories, learning from the past in a creative way. This objective is reached providing the system with the fourth following abilities:

- to support memory of main points (events, alternatives, decisions, facts etc);
- to give a set of skills for reasoning and thinking cogently about the project context (reasoning about impacts, consequences of actions performed, facts happened, decision taken);
- to give the argument structure of the project (explaining how facts, events, solutions and decisions generate from the process, exposing the rationale behind decisions and the causal links between chains event/action -> alternatives/decision -> impacts events/impact actions and so on;
- to persuade the users to reflect and understand the claims the system is communicating, and eventually give the user the possibility to believe/challenge the claims the system is making.

These two perspectives on the use of a memory platform for participatory planning will be investigated in the following of the thesis. In the next chapters we describe the platform design and implementation. Finally two different evaluation studies will be conducted separately in order to test memory building and memory system exploration activities in the chapters from 7 to 10.

5.8 Discussion

This chapter presents the theoretical bases on which to build the design and description of the process memory platform that will be presented in the next chapter.

As a main result we proposed a process memory model which starting from the discourse level support the process memory exploration and representation. Also we described the organizational endeavour that the memory platform should

address to and we identified as following the aims that the memory platform should achieve to effectively support planning organizations at the tree organizational level (community, planning experts' and institutions' level).

The memory platform should support the management and transferability of complex, evolving and eclectic information and knowledge produced during the collaborative processes, thus promoting more reflective interaction.

It should support the discourse level providing an environment to make tangible the connections between planning options, arguments and other issue/documents, thus building common awareness and understanding, not only of the planning issues at stake, but also of the diversity of viewpoints and counterarguments in play in the different planning organizations.

In order this benefit to be reached the platform should be able to:

- Capture, structure and represent information and knowledge generated during and by planning conversations;
- Enhance the management and transparent exchange of these information and knowledge across communication environments, locations, time span and organizations.

This planning process memory platform is conceived as:

- a technical tool for planner to reflect and reuse information and knowledge generated at different stages of the planning process
- a tool for the community to be aware, understand and reflect on what is going on, which are the things at stake, which are the arguments and counterarguments in play
- a tool for local institution and politicians to monitor the community positions, to detect and avoid social conflicts, to discover suitable and agreed policy

The process memory platform is a virtual environment to promote more reflective interaction between those three organizational layers (community, planning teams and institutions) by making tangible the connections between planning options, arguments and other documents and artefacts generated along the planning process. The main problem the memory platform intends to address is the problem of information and knowledge management from extensive base of heterogeneous data generated during the planning process. Thereby the memory platform is first of all a tool to enhance knowledge management and transparent knowledge integration in planning practices. In the following chapters we propose a toolkit of groupware that have been integrated to implement such process memory platform.

6 Design and Implementation of the Process Memory Platform: Multimedia Tools for Representing, Structuring and Managing Knowledge in Planning

This chapter is centred on the description of the process memory platform architecture and of the three tools that have been chosen as modules of the platform. In particular we address RQ2 and RQ3. First the platform architecture will be described in details identifying which in formation and knowledge flows the memory system will support and enhance and how. Furthermore the three tools: Compendium, FM and CoPe_it, will we illustrate focusing on the potential uses of the tools for classifying, organizing, managing, representing, recording and exchanging knowledge in planning practices. Moreover we will describe the integration project of Compendium and CoPe_it! that has been specifically implemented for the memory platform to enlarge information and knowledge contribution to the WWW. We will conclude describing how the integration of the three tools supports deliberation and planning discourse by supporting the capture and management of information and knowledge across different planning tasks, context and environments.

6.1 Towards the Platform Architecture Design

In section 5.4 we described the conceptual model of the memory system. The model consists of three level of memory granularity. The higher one is the discourse level. This is the level in which the row data are manipulated and the transition from data to information happens. To say it differently this is the level of capturing planning conversations and representing them in the memory platform. In this section we define the memory platform architecture and its components.

The memory platform aims to support information and knowledge sharing and integration in participatory planning processes. This implies that planning conversations which happened in different environments, in different phases of the process and involving different stakeholders should be captured and represented in the memory platform. Moreover the platform should support the integration of the captured information in a whole and coherent information flow which shapes the history of the whole project. In this way the planning organization, the interested institutions and the enlarged community can explore and share the contents of the planning conversations and make sense of the planning process history.

We defined this level the discourse level because the captured memory objects are elements of planning conversations which will be represented in form of hypermedia discourse. Hypermedia discourse is an emerging concept developed in the fields of research in hypermedia and discourse (Buckingham Shum '06; Buckingham Shum '07). The hypermedia discourse concept combines discourse-modelling theory with the augmented impact that the exploitation of new hypermedia technology can offer to discourse modelling and representation. In the context of this research, we will specifically define hypermedia discourse the result of a process of capturing, modelling and representation of heterogeneous elements of heterogeneous planning conversations with the support of hypermedia technologies. The heterogeneity of discourse elements depends on the fact that the discourse can be composed of written or talked words, artefacts like documents, images, maps, or any other multimedia data which can be used by the participants to convey concepts and ideas.

The heterogeneity of planning conversations is due to the fact that these conversations happen in heterogeneous means (on line- of line), environments (real world, or virtual settings) and modalities (synchronous and asynchronous interaction).

We designed a process memory platform architecture which supports the process of capturing planning conversations in all these environments and enables the modelling and representation of planning conversations in form of hypermedia discourse.

Figure 6-1 shows the memory platform architecture. The memory platform is composed of three elements: a hypermedia knowledge management system, and two components for capturing planning conversations in two main modes: capturing and annotating video, mapping dialogues with an IBIS argumentation model. Moreover capturing activities span from real world setting (dialogue mapping or post hoc issue mapping, and life video annotation) and virtual interactions (on line collaborative argumentation and video conferencing).

The hypermedia knowledge management system is the heart of the platform because it integrates information and knowledge captured from the platform in a whole knowledge process. It is here that the history of the project is represented and this is the tool the users interface for the three memory levels (discourse, decisions and process level).

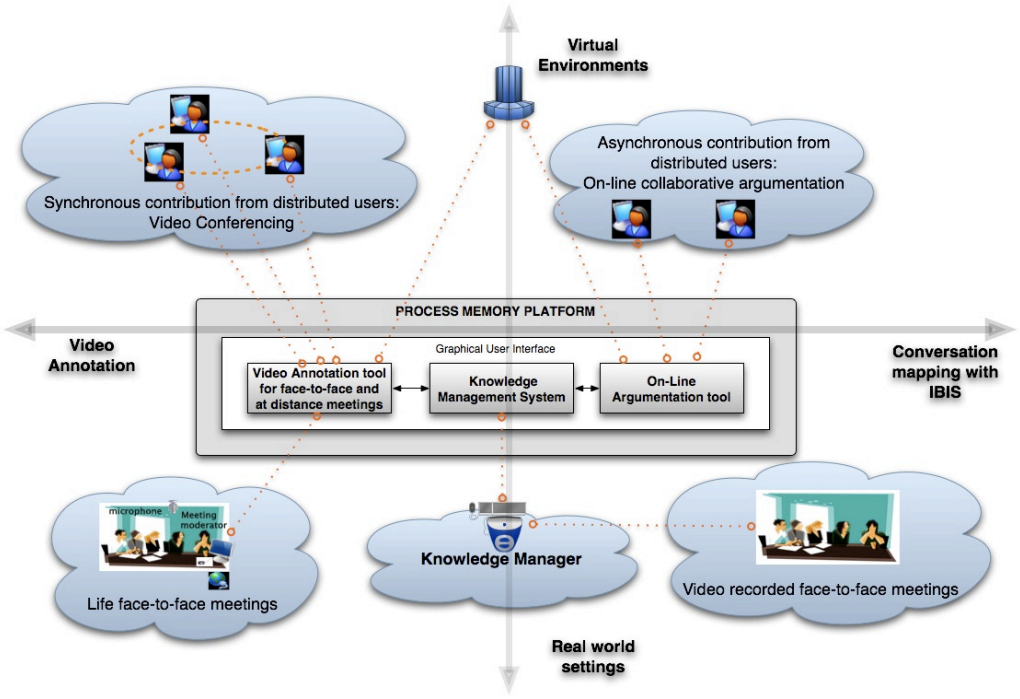

Figure 6-1: The Memory Platform Architecture

The knowledge management system is integrated with the two components in order to allow the import export of information and knowledge generated during the different collaboration forms. Providing the integration between the three tools the memory platform allows the users to explore the process memory while shifting continuously between virtual and real world environments. The process memory platform should provide a space of collaboration to simultaneously discuss, modify and produce knowledge objects blending information and knowledge's produced in different communication modes.

Argumentative collaboration at various levels and in diverse (virtual/non-virtual) groups and contexts (top right quadrant and down right quadrant in Figure 6-1) should be made available.

Also, videoconferences of small groups should enable at distance face-to-face communication. And all results of these meetings should be then integrated and coherently organized in the hypermedia knowledge management system.

The integration of information coming from heterogeneous collaborative environments, (virtual and traditional) and different communication modalities (face-to face and virtual messaging) aims at leveraging the memory platform to a truly collaborative environment with no communication boundaries. In this environment users are no longer constrained to a particular communication environment may it be virtual or real. This approach to capturing and supporting communication and planning conversation open the planning process to a wider community. The memory platform proposes a novel approach to participatory planning providing users with diverse environments for collaboration to accomplish complex knowledge works.

The memory platform allows users to explore the planning project as a unique planning discourse blending between heterogeneous planning conversations. Moreover it allows them to contribute to this planning discourse in several different ways. The main objective of the memory platform is to support reflection and understanding of the planning issues, arguments and counterarguments raised in the different planning conversation. Thereby in order to support reflection and understanding some operational goals need to be addressed. The memory platform should pay attention to keep trace of the social context: who made explicit this information/knowledge, and during which discussion with whom? Moreover the conceptual relationship between different memory object should be maintained: why that information/knowledge emerged and in what context of discussion? Also, the time dimension is key in order to follow the event's dynamics: when the information/knowledge emerged, is used, assessed, or shared during the discussion process? Furthermore information and knowledge need to follow the same visualization means and representation schema in all the environments of collaboration. So that users can easily make sense of information and knowledge even is coming from heterogeneous sources. Finally information and knowledge provided by the memory platform should be easy to access, explore and reuse reusable in all the collaboration environments.

These points define some of the key requirements that the memory platform should fulfil in order to provide a transparent knowledge integration and exchange.

In the following sections we describe the three tools that have been chosen for the memory platform implementation. The choice of the tools has been done taking in consideration some key requirements for the memory platform. Firstly we consider information and knowledge generated in participatory planning discourses highly context dependent. Thereby the tools of the platform should provide large details and allow multiple context representations. Moreover because one of the main goals of the memory platform is to preserve transparency in participatory planning, the information and knowledge exchange needs to be done preserving knowledge from manipulation or mediate interpretation in as much as possible.

6.2 The Platform Modules

In the previous chapter we defined the objectives of the process memory platform, that can be summarize as follows:

- to record and assist the information and knowledge generation and management (expressed in several media: graphs, images, texts, video, audio, etc.)
- to keep trace of the history of decision, around which the new planning organization emerge
- To extract from this history specific or new contents which are, or become during the process, "the focus of discussions and actions"; then, to trace the contents evolution and changes along the process.

Regarding the first objective: the system should provide a multimedia environment for sharing, organizing and representing information and knowledge; this environment should be available to on/line-off/line and synchronous-asynchronous contributions.

Regarding the second objective the system should provide an easy way to trace the planning conversation and to reuse the information and knowledge gathered. In this way planners can better interpret and explain the design rationale and this can be open to understanding and questioning by the community and local institution.

Regarding the third objective the system should provide an environment to store and reuse the results of planning experience so that they can be reinterpreted and re-used in the future in many novel ways.

The instantiation of the process memory architecture proposed consists of three main functional modules CoPe_it!, FM and Compendium. FM and CoPe_it are two collaborative workspaces, while Compendium is the hypermedia knowledge management system user to create and represent the process "history".

CoPe_it! is the workspace for on-line knowledge sharing and exchanging through collaborative argumentation; it consists of a collaborative knowledge repository for on line consultations. The main objective is to open on-line discussions about specific topics enlarging participation to a wider community on the web.

FM is the workspace for face-to-face interaction (both on-line and off line). This workspace is designed to pursue two main objectives: i. to trace planning conversation in its more natural form that is the face-to-face one ii. to insure a more transparent representation of planning conversation by linking claims to the replay of planning conversations.

Compendium is the "history" space. This is the space where the process history is structured and represented; here different information and knowledge from different sources, generated in different times, and with different mediums makes sense of the whole process memory. The results of the collaboration performed in the two other workspaces are directly imported in Compendium environment where they can be structured and represented in a coherent process history.

Figure 6-2 shows the functional module architecture that has been implemented integrating the three described components.

In the following section we will describe in details the system features and functionalities showing how the three workspaces, working in unison, give shape to the process memory as we conceived it.

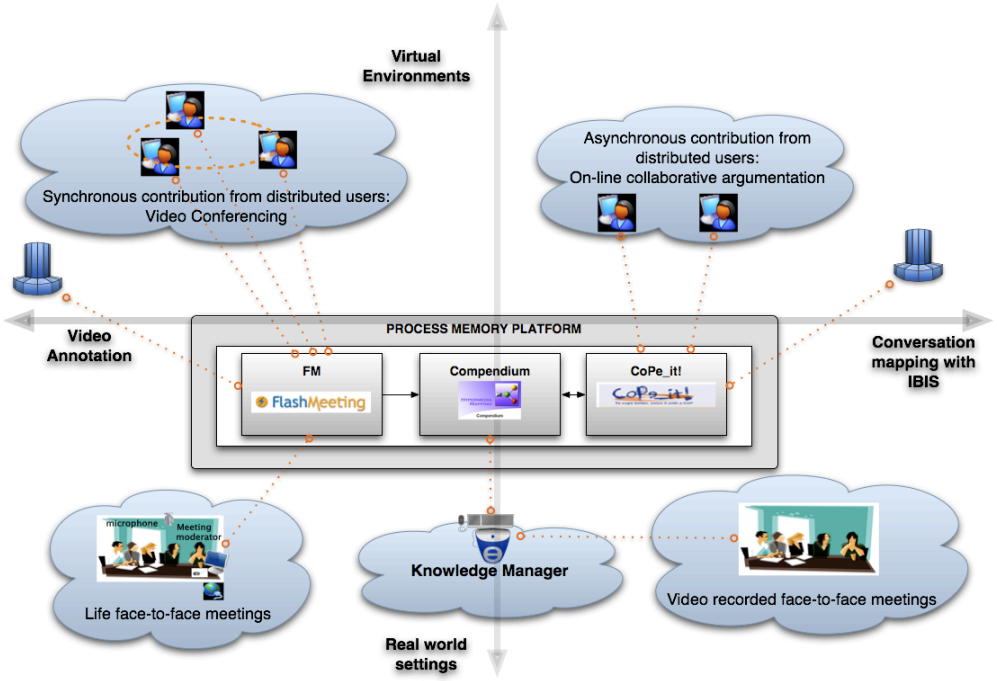

Figure 6-2: Compendium, FM and CoPe_it! in the Process Memory Platform Architecture

6.3 Compendium: A Hypermedia and Sensemaking Tool as KM Environment

6.3.1 Different Uses of Compendium in the Literature

Compendium is the result of over 15 years of research and development (see the Open University, Compendium Institute web site for further info: http://compendium.open.ac.uk/institute/). It is difficult to give one comprehensive definition of the software because different uses are already carried out and new uses are continuously envisaged emerging from the practice and creativity of the users.

From the analysis of the recent state of the art (Selvin and Sierhuis '99) we can group the diverse Compendium uses in two main families : i. in-real-time and ii. post-hoc uses. This distinction mainly refers the work the user needs to do on-the-fly or post-hoc (during and after the meeting).

In the first family we count Dialogue Mapping (DM) and Conversational Modelling (CM) techniques. These techniques require high moderation skills either on the fly (for DM) or both on the fly and post-hoc (for CM techniques).

The first is mainly adopted in face-to-face meetings and Compendium is used for arguments' visualization and meeting moderation: the moderator (possibly assisted by an experienced Compendium user in charge of the mapping) maps the meeting (captures and displays discussion) in order to reach shared understanding about a problem. The process consists of both an incremental negotiation of meanings and the micro-agreements about problem representation (Conklin '05).

Conversational Modelling (CM) has a balance between users' skills in mapping and modelling and the work in and behind the meeting room. In order to apply this technique a Compendium user needs to prepare templates, devoted to model the meeting evolution and to structure the discussions, in order to help and drive the group to decide about and define design variables (criteria, alternatives, priorities, list of actions, etc). In this phase the user applies process-modelling skills and he works behind the meeting room. In order to manage such meetings the CM practitioner needs to be experienced in meeting moderation and mapping, nevertheless the template driven moderation is a valuable support and makes the moderation work less dependent on the moderator skills.

Dialogue Mapping and Conversational Modelling are two techniques for collective sensemaking and these are 'real time techniques' for capturing meeting discussions and involving people in collective definitions and collaborative argumentation about problems.

In the second family, i.e. the post-hoc techniques, we count Knowledge Management oriented uses of Compendium. In these cases Compendium provides users with diverse features for managing knowledge, making sense of knowledge contents and using and reusing information in disparate knowledge works (hypermedia files and documents can be linked and enriched with comments, ideas, tags, etc).

KM oriented applications range from managing a PhD research (Selvin and Buckingham Shum '05) to political debates representation (Ohl '06; Renton and Macintosh '07). In these latter cases Compendium has been used as a Computer Supported Argument Visualization tool oriented to represent a debate, making it easily exportable and eventually open for public discussion on the web. The main objective is to enlarge participation and deliberation about public policies. In these case studies Compendium has been used for post-hoc analysis and representation (mainly mapping) of political arguments. Contents are first gathered by interviews and/or public forums and then structured into argument maps (mainly following an IBIS model of argument representation (Conklin and Begeman '88).

In all post-hoc applications the work on information structuring is committed to a Knowledge Manager who has to organize the contents according to specific objectives (i.e. how to trigger participation? What are the topics to focus on?).

In the light of the examples reported above, Compendium can be defined as a hypermedia and knowledge management tool for individual and collective sensemaking. In the literature it is referred to as an approach to gather, structure, represent, and manage knowledge for individual or collaborative knowledge intensive works. In a Compendium approach knowledge objects (ideas, multimedia documents, artefacts, etc) are represented as nodes of a graph like structure; afterwards nodes are linked between them in order to make-sense of individual and/or collective concepts and concerns.

6.3.2 Key Features: Nodes Map and Transclusions

What make Compendium different from other concept mapping tools are his hyper-textual and hyper-media features. In compendium the hyper linking feature between multimedia knowledge objects is empowered trough two main features:

- Map node types and
- Transclusion links.

The combined action of these two features make hyperlink not constrained to linear explorations on a 2D canvas allowing transversal hyper-space linking of nodes. Figure 6-3 shows an example of both these features. A MAP node is an anchor to a 2D space, which is the source or destination of a link with the map node.

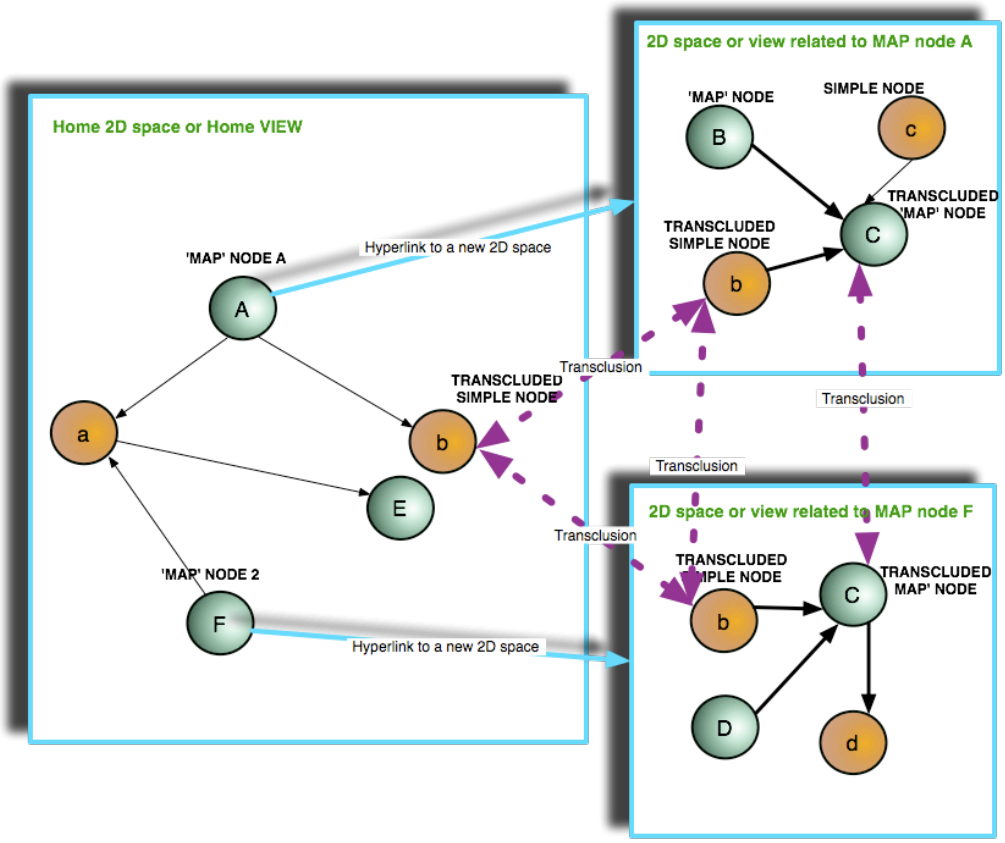

Figure 6-3: Hyperspaces Linking Through MAP Nodes and Transclusions in Compendium

A MAP node is an anchor that corresponds to a whole node (see MAP nodes in green in the Figure labelled with capital letters). Clicking on the anchor node (MAP node) you follow the link and open the 2D space in which other simple nodes and/or MAP nodes are internally linked building a horizontal node network (see in the picture the hyperlink to a new 2D space as a light blue link). If the 2D space contains a MAP node this node opens an external link to a new 2D space, which can be accessed clicking on the MAP node (the click causes the external link to be followed). We call this link external because it refers to knowledge object which are not included in the same database, being a database a collection of nodes not necessarily all linked. We mean for database the content of a 2D environment/canvas. Therefore a MAP node is not a map containing a 2D

environment, it is instead an anchor node connecting to a 2D environment, which will be accessed and referred to that MAP node. MAP nodes normally have a label, which can be considered the title or concept associated to the hyper linked 2D space.

The second key feature is the Transclusion. Transclusion is an external hyperlink between one node and an image of the same node in a new database. It is different from duplication or copy because the object remains just one, but it is visualized in two or more hyperspaces. In Figure 6-3 we can see two example of transclusion (cross-hatching links in the figure):

- transclusion of simple nodes (orange nodes labelled with lower case letters in the figure); the same simple node "b" has been transcluded in three views (the home view, the view related to node A and the view related to node B. Double side arrows show that the user can move from one view to the other and then reverse.
- Transclusion between two MAP node (see green node "C" in the figure; in this case nodes, when transcluded, can be organized in a different way, linked to different nodes or documents, moved freely in the 2D space without effecting the position or links of the same node in the other spaces in which it has been transcluded (see that in Figure 1 transcluded nodes have different positions and are linked to different nodes).

So the two functionalities (transclusion and map nodes) allow hyperspace linking of two kinds:

- Map nodes enable node-2Dspace linking, that is to say, linking a node in a database with a new 2D space.
- Transclusion enable 2Dspace-2Dspace linking, that is to say a link between two spaces trough the same node (transcluding the same node in different databases; this options allow a node to be read in several hyperspaces).

These options are key in order to build a hypermedia environment to manage knowledge generated in a participatory planning process because they allow structuring and representing information and knowledge according to their multiple dimensions in multiple spaces. Furthermore these spaces can be linked between them in several ways and specific exploration paths can be suggested or allowed to the users. Ideally different path can be chosen for different audit.

6.3.3 Compendium's Role in the Memory Platform

We are going to pursue in this thesis a different attempt to use Compendium as a multimedia process memory in the participatory planning domain. In the applications we will present in the third part of the thesis (see chapter 8 and 9) we show life and post-hoc analysis of videos, interviews, documents, graphs, photos, and other material, conducted to map the memory of a participatory planning processes.

So far we discussed the reasons why we chose Compendium as a Hypermedia environment to manage knowledge in participatory planning. We now discuss the information and knowledge typologies that have to be represented and managed, making sense of how we organize the Compendium hyperspace.

In all the applications we aimed at capturing and representing planning conversations thereby information and knowledge to manage with Compendium are: statements in a discussion, images, photos, stakeholders pictures, graphs, geographical representation of the area of study, documents like technical reports, references, url linking to web-pages, pdf sources of information, video or audio files, files records of meetings of different groups of consultation processes, etc. We already define and described these objects as 'knowledge objects' in section 3.2.2; in the hypermedia lexicon they could be referred as node or documents in the hypermedia network. Knowledge objects are the unit of information for the knowledge management system, in Compendium they can be represented, linked and moved in hyper-linked 2D canvas (spatial hypertext) (Shipman and Marshall '99) making sense of a network of nodes about a specific concept or concern.

The heuristic classification of knowledge objects that will be used to structure information and knowledge in planning conversation has been already discussed in 3.4. This is consisting of 5 classes each of them representing a key contextual dimension for knowledge production and representation. Each of the five dimensions corresponds to one or several linked hypermedia databases (2D spaces in the hypermedia environment, in Compendium lexicon they are called "views"). Each dimension shows one context in which the knowledge object can be read and interpreted. Each Knowledge object is represented as a node in the hypermedia system and it can be transuded in more then one view, according to the contextual dimension it expresses. This classifications mirrors the organization and indexing of the knowledge objects in Compendium, according to five key contextual dimensions. In the following of the thesis we will present several applications in which this heuristic classification of knowledge objects has been applied to represent and structure real knowledge generated in case studies in the participatory planning domain.

6.4 FM (the Flashmeeting Project): Video Recording and Annotation for Face-to-Face and Virtual Meetings

FM (the Flash Meeting project) is a tool developed by KMI (Knowledge Media Institute, Open University) within the Flash Meeting project (see the project web site at http://flashmeeting.open.ac.uk/home.html). It is an application designed to allows a dispersed group of people to meet from anywhere in the world in virtual meeting rooms. The only think it needs is an Internet connection. FM has been developed within the educational field of research and gives insights into how live videoconferencing can be used to support online communities and to create new reusable learning objects (Okada, Tomadaki et al. '07).

We learned from the FM insights and we proposed to enlarge the use of FM to the support of off line communities and to the creation of reusable knowledge objects from face-to-face meeting recording. In fact this application provides very features that would be extremely useful also for face-to-face meetings.

In particular FM allows recording of meetings and annotation, by taking trace of several information. We are particularly interested in the record of:

- Participants' statements (what they say)
- When along the meeting (possibility to point to specific contributions by author in the replay phase)
- How many time and how long they spoke (this allow post hoc analysis of the different stakeholders contribution to the meeting)
- Annotation of important moments of the meeting (sharing this with the stakeholders live during the meeting and/or making it available in the replay)
- Annotation of spatial object on maps collaboratively manipulated during the meeting (possibility to take different snapshots of the same map, taking trace of the different annotations along the meeting, taking trace of the map evolution)

Thereby the research sub-questions we addressed are the following: How FM can be integrated and used with Compendium in order to add information and knowledge produced in face-to-face meetings to the Compendium Project? Which are the possible procedure of meeting management and mediation to be applied in order to maximize the use of FM for video recording and annotation in face-to-face meeting (according to the features at present available)?

The main idea was to enrich Compendium maps that represent discussions and argumentations raised in face-to-face meetings, with references to the video replay of the face-to-face meeting itself.

In the attempt to customize FM for the video recording and annotation of face-to-face meetings we tested two different annotation procedure (post-hoc or life annotation) and two annotation methods (single video track and multiple video track methods.

6.4.1 Post-Hoc Analysis and Annotation of Meetings' Videos

The first procedure consists in video replaying a meeting video and annotating it post hoc with FM. The meeting replay cannot be paused in FM thereby the annotation of the video is like a simulation of life annotation of the meeting.

In this annotation procedure it is like a note keeping process where the notes can be actually referred to specific meeting moments. We tested this procedure in the SPP case study that will be described in chapter 9. We added annotation to the video of the consultation meeting with the SPP community. The annotation was post-hoc, and we decided to add annotations to the video exactly at the moments in which the statements (previously considered relevant and added to Compendium memory system) occurred. At the end of the flash meeting session we imported the XML file in Compendium. In this way after the import we could link the node of the claims represented in compendium to the index to the video replay in which that claim has been raised. When we decided to take note in FM the list of the notes is converted in Compendium in list of annotations linked to the video. Each annotation refers to a specific statement. This allow to associate to each statement in the memory system a reference node that is pointing exactly to that moment in the meeting, so that each user can replay the meeting starting from that point.

6.4.2 Live Recording and Annotation of Face-to-Face Meetings

This second procedure can be applied if the annotation is done live during the meeting. A web-cam is pointed on the meeting table in a position that allow each participant to be in the video. A multi directional microphone is located on the table in order to catch participant's voices. The meeting annotation and the FM session start together with the face-to-face meeting. Figure 6-4 shows the meeting model. This procedure has been tested in the case study of MK (see section 8.3). In this case study the annotator worked in collaboration with the meeting moderator. As we will describe better when we will talk about the case study life annotation makes faster and more effective the representation of the meeting claims and reduce the work for the knowledge manager to do after the meeting.

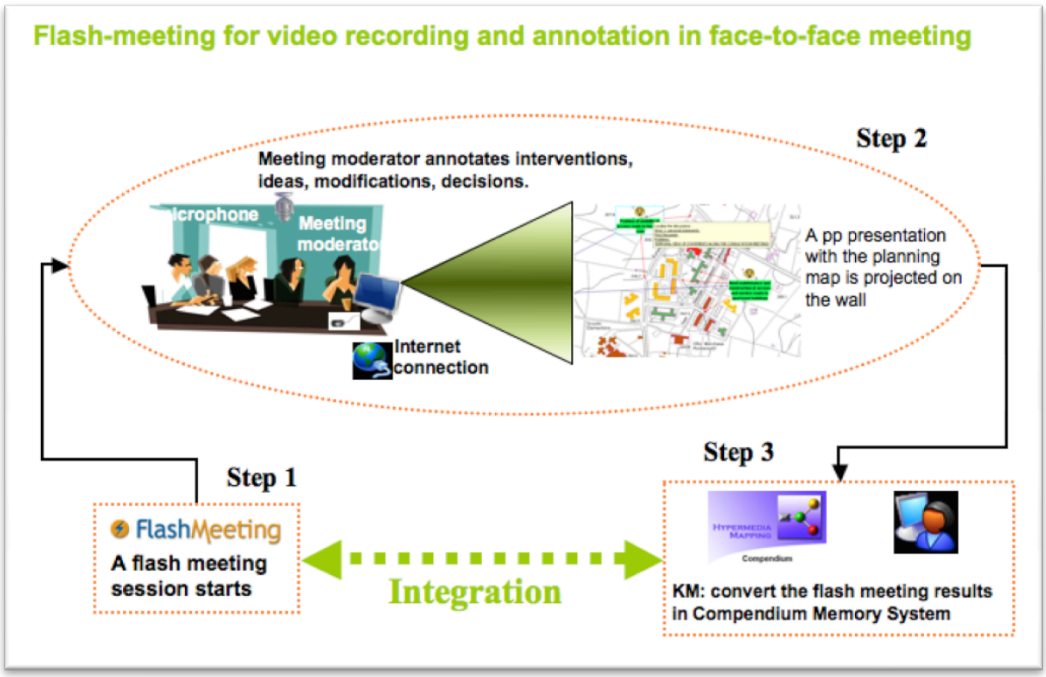

Figure 6-4: FM for Video Recording and Annotation of Face-to-Face Meeting

Moreover in both procedures the annotator can follows one of the annotation methods suggested below:

- one video track procedure (single broadcasting and annotations for: participant's interventions, key issues, decision moments)
- multiple video tracks procedure (multiple broadcasting and annotation for: key issues, decision moments)

6.4.3 Single Video Track Procedure

Ones that the flash meeting session is booked the M (moderator) enters the session typing in the name box: "Video track". Then the meeting starts and the M starts the broadcasting from the "Video Track" window. In this way "Video Track" is like the only participant to the meeting. It means that a sole video track is recorded.

Then in order to take trace of different stakeholders' contributions the moderator has to follow the procedure here below: Associate one number to each participant.

If actor "4" starts speaking, M has to type "4" in the annotation board and then press enter. This is the standard mode of annotating. Within this is going on, if while actor "1" is speaking a decision point is reached the moderator write "d" in the annotation board and then press enter. A subsequent annotation can specify the content of the decision or this specification can be left for the following phase when the indexes to the video are imported in Compendium. Same procedure for annotation of key moments or key ideas: if while actor "3" is speaking a key idea is raised the moderator can annotate that during the meeting while the actor is speaking.

6.4.4 Several Video Tracks Procedure

Ones that the flash meeting session is booked the M (moderator) enters the session typing in the name box: "Actor1 name". Then it enters again the session typing in the name box: "Actor2 name". M repeats this action one time for each participant plus the moderator (if he is supposed to have un active role in the meeting moderation he has to be considered as un actors, another possibility is to consider two people one moderating the talks the other using the laptop and managing the video annotation).

When all the participants' names are in the session the meeting can start. The broadcasting starts when the first actor takes the floor and starts talking. Then the M starts the broadcasting from the personal page associate to that actor. When another actor intervenes or answers, M stops the broadcasting from the previous actor and he starts broadcasting from the new actor personal page.

6.4.5 Advantages and Disadvantages of the Two Annotation Procedures

Single Video Track Procedure

This procedure is quite easy to apply and it doesn't require too intrusive actions on the discussion flows. If we already know the participants and we previously associate to them a number it is quite easy annotate interventions, even in fast answer/replay discussion. As a disadvantage the Memo Replay doesn't give you a visual representation of different participants' contributions, but it retrieve just a single video track. (Figure 6-5 here below)

Figure 6-5: Single Video Track Procedure

If we consider our main purpose this is not a big problem because our main objective is to enrich compendium argumentative maps in the memory system. So we just need to point the video replay to specific moments of the meeting, but we do not really need to explore the meeting through the flash-meeting Memo replay page.

Several Video Tracks Procedure

The second procedure is heavier for the meeting annotator. In fact she has to manage more then one web page; she has to be fast and effective in stopping and starting new broadcastings, this can be particularly problematic if one actor intervenes interrupting another one. In this case could be necessary a second moderator who chairs the discussion, he has to give the floor to the actors, avoiding overlaps of different voices.

On the other hand this procedure allows better exploiting of Flash-meeting features (see Figure 6-6).

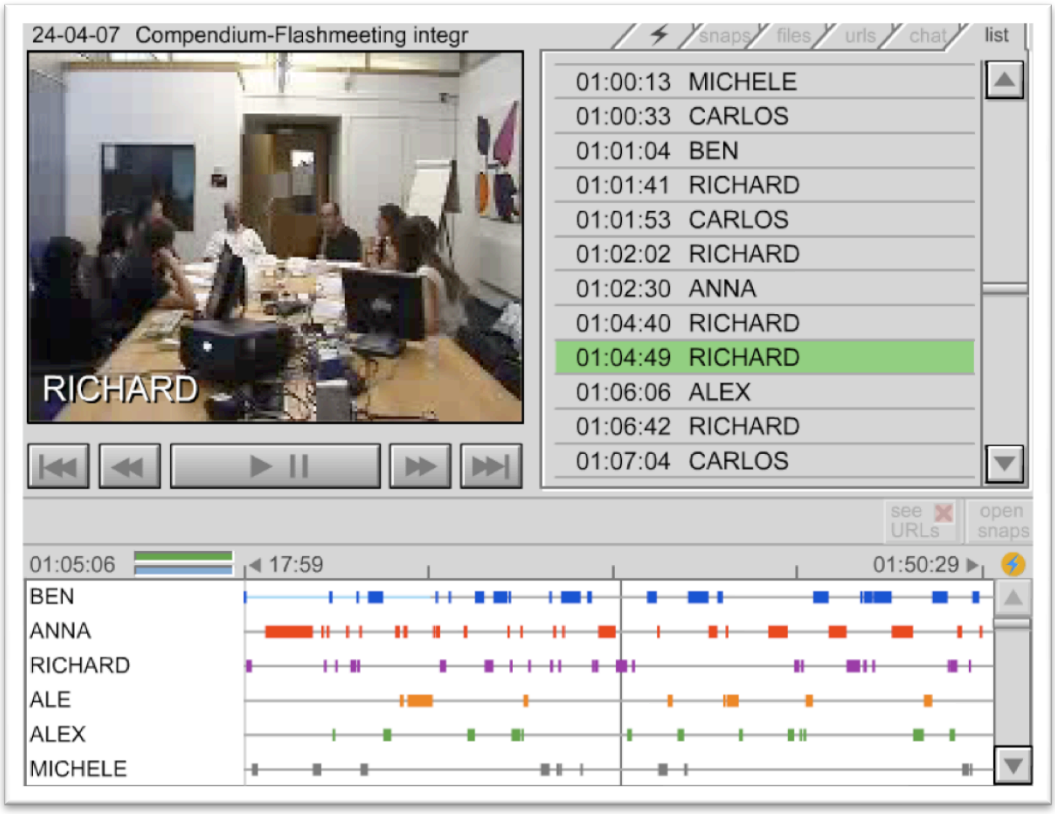

Figure 6-6: Several video Tracks Procedure

The Memo replay page give you back different track for different authors.

As we can see in the previous image each participant have a meeting band showing when he intervened. The meeting can be also explored by actor, i.e. watching just the replay of the person we are interested in. The meeting can be jumped just moving the vertical gray bar to the moment we desire. FM also provides some reporting and statistical analysis on the meeting results automatically generated at the end of the meeting. (How long actor 1 talked? How much actor 3 talked compared to the others? Who talked more? When happened the most debated issues of the meetings? Etc). This annotation methods allow to maximize the video analysis supported by FM thereby it has to be considered the best procedure to follow. Moreover if from one hand this procedure is good because it allow post hoc analysis of the different stakeholders contribution to the meeting; on the other hand some voids will be for sure present in the video track corresponding to the time the M needs to switch between different actors broadcasting.

6.5 CoPe_it!: Enlarging Information and Knowledge Capture and Exchange to the WWW

CoPe_it! is a young software developed in the context of a EU project, Palette (Pedagogically Sustained Adaptive Learning through the Exploitation of Tacit and Explicit Knowledge) started last year. Mainly it is a web-based tool supporting collaborative learning in on line communities of practices (Kimble, Li et al. '00; Kimble, Hildreth et al. '01).

CoPe_it! has been designed according to what the research group describe as an incremental formalization approach (for references see (Karacapilidis and Tzagarakis '07); it is based on the idea that different levels of formalization of the argumentation contents need to be provided in order to support collaborative decision making.

CoPe_it! supplies members of on line communities with different features in order to deal with argumentative discussions. The software supports i. definition of alternative solutions and ii. analysis and evaluation of the discussion contents in order to drive groups throughout decision making processes. CoPe_it! is more than a web tool for collaborative argumentation; it is rather a tool supporting learning processes in virtual communities of practices. It supports i. the first step of problem setting, ii. the definition of alternative solutions; iii. the discussion and negotiation of meanings, pros and cons of each alternative, and finally; iv. the analysis of content and the definition of solutions priorities.

CoPe_it! offers basically three levels of formalization corresponding to different representations of argumentative discussions, each of them associated to one of the following views:

Desktop view: it consists in the lower level of formalization; the community members can add contents in the most user friendly way (in a Compendium like approach). This is an intuitive way of gathering contents from the users without forcing them with pre-defined communication rules.

Formal view: this view consists in a machine-readable version of the previous one. Predefined algorithms of conversion are applied to the desktop view contents in order to convert them in an IBIS-model like argumentative discussion.

Forum view: this view represents contents in a temporal sequence showing contents and node types (statement, argument, document type, etc).

Future developments include the support for simultaneous posting from all the tree views. Another important improvement to be implemented concerns the possibility to define and negotiate with the community members the specific algorithm of conversion between the desktop view and the formal one. This opportunity will couple a tool for collaborative argumentation with a valuable support for decision-making processes. CoPe_it! provides members of communities with a common workspace where they can post and share ideas, resources, and arguments in a way that makes sense to them. Community members are registered and have specific names, roles and privileges within the community. Each user is assigned his personal workspace and he can make it private and organize his/her own ideas and contents to be eventually shared with the group in a second moment. Knowledge items can change during the discussion (free interchange between node types: idea, comment, and note) and they can be linked with personalized links (of specific thickness, colours, and labels). Nodes can be arranged and moved freely in the workspace, and they can also be clustered using adornments (colour rectangles used to group together nodes). Other interesting features are i. the possibility to open a new browser for searching information by Google and Wikipedia, ii. the possibility to subscribe to RSS feeds, and defines and manage a list of bookmarks.

6.6 Compendium - CoPe_it! Integration Project

Unlike the case of Compendium and FM that are both tools developed by KMI Open University and that were already integrated as a result of a jointed project performed by the Compendium and FM teams. Cope_it! and Compendium integration has been specifically designed and implemented in order to enlarge the contribution to the memory platform to a wither community on the web. In the following section we first describe the two tools and motivate the reasons of the integration. Then we describe the integration process and the obtained results. Moreover as in the case of the other two components of the memory platform, the integration will be tested in real planning case studies (see PAU and TG case studies at sections 8.4 and 8.1)

6.6.1 Discussing Similarities and Peculiarity of the Tools

Although addressing different tasks, Compendium and CoPe_it! show high integration potentials mainly because, they share similar communication principles and visualization means. Starting from the analysis of peculiar features of the software, (see the following table) we want to make visible the complementarities of the tools.

Table 6-1 shows in light-grey features which are similar (or will be similar referring to the future planned versions of CoPe_it!) like: export and import formats, source code distribution policy, administrator rights (registration and download), visualization and structure of contents (supported file types, IBIS model of argumentation, tagging etc).

Dark-grey rows identify the features in which both systems complement each other. The first feature refers to the communication mode (on-line/off-line use). Since we are interested in knowledge exchange between virtual/non-virtual spaces, candidate tools for the integration need to be complementary with regards to this feature.

Other key aspects where the two systems show complementarities are: at distance synchronous and asynchronous collaborations; users' roles, rules and privileges; hypertext features; personalization and revision of contents; Decision Making support. Starting from the software analysis and focusing on the complementary aspects, we can identify the main mutual advantages of the envisaged integration.

In the following tables (Table 6-2 and Table 6-3) we analyze complementary features trying to link each of them to the relative additional feature it would provide both to Compendium and CoPe_it! users, in the case the integration is successfully implemented.

Table 6-1: Compendium and CoPe_it! Main Features

Main Features	Compendium	CoPe_it!
Export formats	It supports 5 formats: XML, Jpeg, Html - web-maps and web-outline, power export.	It will support XML files and Jpeg format (not yet delivered)
Import formats	It supports XML imports, images and image folders, Quest Map files, Flash- Meeting files	It will support XML files and Jpeg format (not yet delivered)
Free download/access	YES	YES
Source Code Distribution Policy	Open source	Source code is intended to be released
WEB-BASED	NO	YES
Software download	YES (you need to download Compendium in order to access the full functionality)	NO (you do not need to download any software)
Registration	Needed the first time for the software download.	Needed the first time to get the User ID and Password and to get the administrator acceptance
Members attributes	There are no roles, rules and privileges imposer to the members not even any administration control on contents	There are roles, rules and privilege within a community
At distance asynchronous collaboration	YES - only on local networks	YES (through the web)
At distance synchronous collaboration	NO (yes - only slow performances)	NOT YET (it intends to be)
Structure of contents	No contents structure are pre-imposed	Desktop view: flat; formal view: rules of communication and contents have a pre-defined structure
References: supported file types	Drag+drop in any document, website, email, image	At the moment you can upload any kind of local file type, not yet any kind of file on the web
Support IBIS model of argumentation	YES	YES Partially (it doesn't support 'question' nodes, each question is supposed to be addressed in a separate workspace)
Tagging	You can choose between default tags and assign your own keyword 'tags'	NOT YET (it intends to offer some tagging features)
Personalization and customization of icons, backgrounds, colours, links, etc	You can create your own palettes of icons, links types, colours	At the moment no personalization features are present. Some features are under consideration for future versions:

		e.g. links colour)
Hypertext features: Transclusion	You can place/edit a given knowledge object in many different views (supports transclusions)	Does not support transclusions, objects of different workspaces cannot be copied or linked
Contents revisions	Allows continuous changing and reviewing of contents and their organization	Does not support contents modification and revision (just erasing or adding new contents)
Information overload	It supports maps with large numbers of nodes	Not suitable for large number of nodes (very slow)
Support Decision making	NO (yes, only when paired with human assisted techniques)	YES (Support automatic generated view for different purposes)

Table 6-2: Additional Features that the Integration Can Provide to CoPe_it!

Compendium ----------> CoPe_it!		
Additional features		***Complementarities***
1. Enlarges the advantages of real time capturing and integration with different materials, information, documents and hybrid files so that the face-to-face meeting memory can be shared in and out the meeting group		Compendium complements Cope_it! offering real time capture of meeting
2. Provides CoPs with a hypermedia environment in which community members can use, correlate and manage contents of different collaboration spaces (contents raised in different workspaces can be discussed and transcluded in new contexts)		Compendium complements Cope_it! offering transclusion features
3. Offers a KM tool in which community members can organize, structure and define information and resources also being off line on their machine, but always giving them the possibility at any time to publish content on the web and to share them with a list of community members or making it public for the whole VCoP		Compendium complements Cope_it! offering an off-line KM tools
4. Toward un Organizational Memory System	Exports Cope_it! discussions in an off line environment without no problem of information overload (Compendium support maps with thousands nodes)	Compendium complements Cope_it! supporting maps up to large number of nodes
	Allows to customize organization and archiving of knowledge objects in larger organizational databases (linking and referring discussion contents to any other off-line and private data sources)	Compendium complements Cope_it! offering customization of knowledge object and hyper textual environment running on your machine

Table 6-3: Additional Features that the Integration Can Provide to Compendium.

CoPe_it! ----------> Compendium	
Additional features	***Complementarities***
1. Opens Compendium face to face meeting to a wider community on the www	CoPe_it! complements Compendium offering a web-based argumentation environment
2. Gives the possibility to trigger online discussions on specific topics (this is particularly useful in Public Policy cases)	CoPe_it! complements Compendium offering the possibility to modify and enrich Compendium maps directly on the web
3. Provides at distance Compendium users with an environment of asynchronous discussions that can easily be imported in their Compendium maps	CoPe_it! complements Compendium offering synchronous interaction for real time at distance discussions
4. Gives to Compendium based Process memory system the possibility to update results of at distance meeting and consultation forum on the web	CoPe_it! complements Compendium offering the possibility to import, in forms of Compendium maps, contents of at distance meeting and consultation forum
5. Offers support for Decision Making	CoPe_it! complements Compendium offering automatic analysis of Compendium maps, with customized algorithms

6.6.2 The Integration Project

In the previous section we gave evidence of the mutual advantages when integrating Compendium and CoPe_it! In the following we will discuss the integration proposal describing three possible scenarios:

First scenario: Importing CoPe_it! workspaces in Compendium maps (from virtual to real world settings – from virtual communities to real world setting communities).

Second scenario: Importing Compendium maps in CoPe_it! workspaces (from real to virtual world settings – from real world setting communities to virtual communities).

Third scenario: both side imports.

In the first scenario the main goal is to enlarge to communities on the web discussions and collaborative knowledge works performed in real world communities. In order to make on and off line discussions completely complementary and to allow the on-line discussions to evolve together with the face-to-face process, we need to transfer into Compendium the contents gained in CoPe_it! workspaces. Contents can be imported in Compendium and then re-organized, linked and discussed within the same community or in different ones during ad-hoc face-to-face meetings.

The second scenario aims at:

- importing Compendium Dialogue maps in order to discuss within the virtual communities the results of face-to face meetings;

- importing single-user concept maps used as a reference for arguing something in the virtual discussion
- importing Compendium templates and models in order to trigger, organize or moderate the discussion in new workspaces.

The third scenario is the bi-directional integration between both tools, and it exhibits the benefits gained by performing the two scenarios already described. An additional advantage is envisaged: the results of virtual meetings can be submitted to the discussion in traditional communities (scenario 1) and the results of face-to-face discussions can go back to virtual environments (scenario 2) closing the cycle and allowing further contributions from the virtual community. This possibility provides means for continuously validating and revising contents from virtual to real world settings and vice-versa.

For the envisaged scenarios diverse technical solutions have been explored. In Figure 6-7 three options for implementing the three scenarios are synthesized: one manual and two automatic options.

In the first option a knowledge manager is in charge of the knowledge integration and exchange between both systems. This option offers three positive opportunities: i. to select specific knowledge contents according to specific needs, ii. to control and avoid knowledge redundancies, and iii. to locate imported and exported maps in their original position (spatial positions in the two-dimensional canvas) that is crucial for contents' interpretation. On the other hand, this option enhances external influence on knowledge interchange (knowledge manager interpretation) and the time and effort required to be implemented.

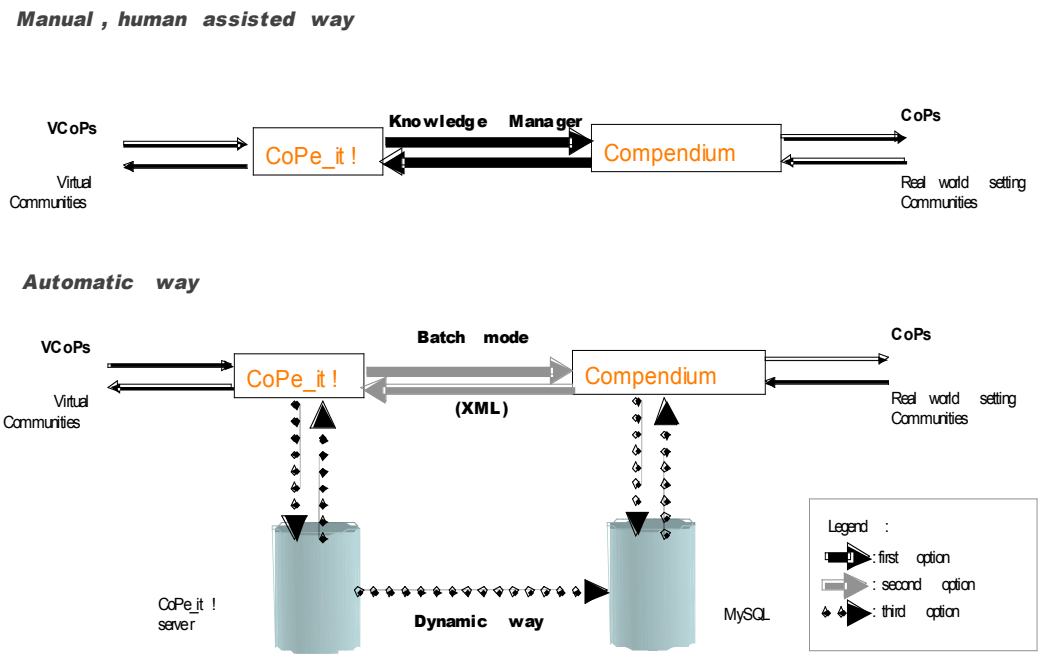

Figure 6-7: Technical Options for the Proposed Integration

In the second option the knowledge exchange is performed in batch mode, allowing XML export/import. This option has the advantages to be transparent and fast but

it presents several theoretical and technical criticalities in the definition of conversion rules. Therefore efforts have to be devoted to:

- defining conversion rules for contents export for CoPe_it! – Compendium objects: i.e. nodes types (each one with its features - title, descriptions, reference files, etc), links (with colours, thickness, texts labels, etc), adornments (with colours and titles), documents and reference objects (addressing compatibility and equivalence of document formats);
- building a XML export/import readable in both systems (compare and integrate XML schemas, detect information and decide how and which ones of them can or have to be converted, etc).

In the third option the integration is obtained connecting Compendium and CoPe_it! databases. This option offers additional capabilities by allowing synchronous update of both Compendium and CoPe_it! spaces. In this scenario, virtual and traditional communities can work together in synchronicity on the same project or collaborative knowledge work, with different means but in a unique hybrid environment. This is a suitable environment for hybrid communities like the one involved in the planning process, in which members can:

- shift continuously between virtual and real world environments
- simultaneously discuss, modify and produce knowledge objects in a whole hybrid space of collaboration.

This type of integration provides on line community members with a new collaboration space in which they have the opportunity to perform argumentative collaboration at various level and in diverse (virtual/non-virtual) groups and contexts.

We implemented the second scenarios and we allowed both side import export of Compendium maps on line in CoPe_it! workspaces and vice versa.

The main objective reached with the integration between Compendium-CoPe_it! is to extend discussions and deliberation started during face-to-face consultation meetings to a wider community on the web. CoPe_it! can be used with different communities (planners, citizens, technical groups) to discuss different topics and themes emerging during the planning process.

Although addressing different tasks, Compendium and CoPe_it! share similar communication principles and visualization means thereby the integration results allowed to create almost identical maps thus preventing misleading interpretation and minimizing the information lost in the information exchange process. In Figure 6-8 we show a results of an import of a Compendium map in CoPe_it workspace.

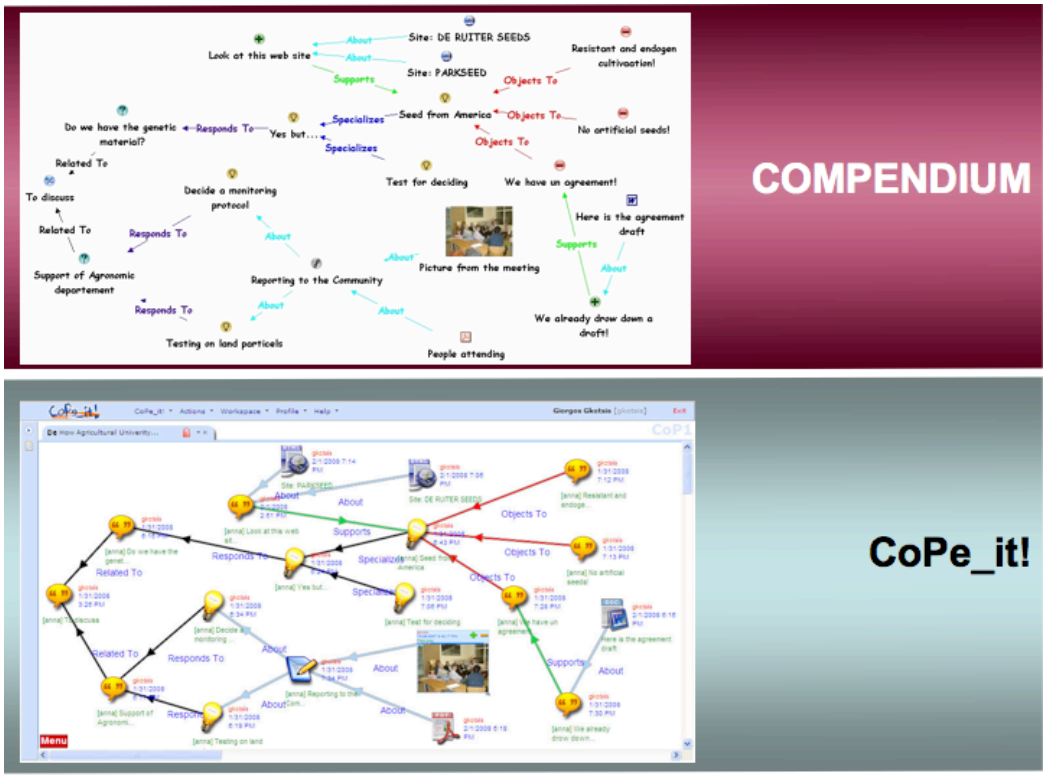

Figure 6-8: Integration Compendium-CoPe_it!

As we see in the image (Figure 6-8) Compendium and Cope_it! integration provides quite good results. Knowledge objects like statements, narratives, images, documents can be represented in the same position, with similar icons (exception made for the question icon, which is not supported by CoPe_it! In essence, CoPe_it! makes some Compendium features available on line so that off-line and on line discussion can happen in a unique planning discourse. In the third part of the thesis we will give some real examples of how the two tools can be used in participatory planning processes.

6.7 Discussion: A Knowledge Media Tools Integration Perspective

Capturing deliberation along collaborative decision-making processes is a challenging task. Several stakeholders deliberate in different moments, trying to accomplish different tasks, collaborating and communicating with different people and working in different environments. Knowledge derived from parallel processes, driven and interpreted by different actors needs to be captured managed and shared in order to make decision-making transparent, shared and accepted by the local communities. Given this understanding, different critical questions should be considered: Who was involved in the specification of relevant knowledge sources? How do the different stakeholders interpret the data? How can we capture and integrate diverse perspectives from different community groups, planners, and government?

In this chapter we showed that communication technology and multimedia offer novel way to face the problem of knowledge representation and management. We presented the integration of the three-multimedia groupware in the process memory platform to capture deliberation in participatory planning practices.

Main objectives of integration of the different tools in the memory platform have been:

i. to support the capture, negotiation and integration of information, ideas and arguments from different community groups and planners,
ii. to manage all these information and knowledge across tasks (i.e. exchanging information from public consultation meetings and then using it as a reference for technical and political choices) context (i.e. exchanging information between different teams and organizations) and across environments (i.e. using face-to face meeting results to inform web-consultation experiences and vice versa).

We present three tools Compendium, FM and CoPe_it! and we showed how these tools have been integrated in the memory platform for knowledge tracking, linking and exchanging. Moreover we have discussed how the tools can be used in the course of real participatory planning projects.

These tools comes form different research fields and are designed for different scopes, but they have been customized, applied and integrated in order to be used for participatory spatial planning purposes. We will briefly describe them, illustrating how they have been integrated and how this integration enhance their use in planning domain.

Compendium is a hypermedia and sensemaking tool; we used it as an environment for managing knowledge and information. It allows representing the same information in different views that refer to different contexts. In particular it has been choose to implement the knowledge object taxonomy to represent and manage information and knowledge in planning which has been proposed in section 3.4. (in particular social, conceptual, temporal, spatial and design rationale context). Compendium provides the user with the possibility to freely navigate the system jumping from one view to another. In the following several application examples will be given showing how different views can be key for different planning tasks.

Compendium is the hypermedia environment used as knowledge management tool; its hypermedia features are extremely useful in knowledge representation in multiple contexts, but much work need to be preliminarily done in order to capture, tag, and link all information in the flow of a meeting. This introduces a relevant level of discretionarily. The integration between Compendium and FM solve this problem. We have shown how video of meeting can be annotated on the fly during the meeting with FM and then annotations can be imported in the Compendium hypermedia database. Annotations consist in indexes to the video-replay and are used as references for the knowledge claims and concepts. In this way, when navigating the meeting contents, users can replay the meeting pointing to the moment in which the specific claim has been done. This feature is a powerful enhancement for deliberation capturing because it preserves contents form wrong

interpretation and manipulation. This makes the deliberation process fully transparent.

For our purposes FM has been used both i. to allow at distance meetings between stakeholders involved in the planning process and ii. to video annotate face-to-face meetings of technical teams, political teams and/or local community groups, in order to preserve transparency when tracing and representing deliberation.

The integration between FM and Compendium then allow to update results of FM meetings in Compendium hypermedia environment where virtual meeting contents can be enriched and merged with any other kind of multimedia information, knowledge and documentation about the planning project, previously stored in the hypermedia database and being available off-line. Thereby the integration between Compendium and FM offers a valuable support to preserve transparency in deliberative practices.

On the other hand we showed how the integration between Compendium and CoPe_it! support technical planning practices with effective tools to collect and manage knowledge about deliberation and then to communicate them to the community. The integration between Compendium and CoPe_it! shows how deliberation can be enlarged to a wider community on the web by coupling on-line and off-line consultation into a unique process of knowledge exchange and production. The following part of the thesis describes case study and evaluation. The memory platform, that is to say its integrated components will be tested and evaluated in several case studies in the participatory planning field.

III Case Study and Evaluation

7 System Applications and Case Studies

This chapter introduces the case studies. A multiple Case studies approach has been chosen because it is impossible to investigate all the research questions and test all platform features in a single case study. The case studies framework will be explained making sense of what different platform features will be explored and what research sub/questions will be tested in each of the case studies. In the chapter each case will be described, specifying the research question it intends to address, the research method used, and the evidence provided by the case study.

7.1 Multiple Case Study Approach

The main objective of the evaluation study conducted in the thesis is to evaluate the prototype memory platform. To do so several demonstration projects have been conducted in parallel. Demonstration Projects are real-life action projects or programmes that have a long tradition in the fields of public education, programme evaluation and federal policy making (Yin 92). The purpose of demonstrations carried out in the thesis has the same role as in policy-implementation and policy-formulation research, but the focus is on the evaluation of new planning practices at the technical, political and community levels. Each demonstration targets not only the technological development of the process memory system supporting participatory planning, but considers also the implications for methodological and technological change at the professional level. This methodological and technological change then implies a change of approach to planning practices at the political and community levels (see Figure 5-1 to see the planning organizational levels).

We will use different evaluation methods in the same evaluation study to evaluate the memory system against different objectives.

The six demonstration projects are at different scales, involving both organizations and individuals, and activities across multiple sites.

These make it impossible to exert tight control over conditions, as one would within a controlled experimental research paradigm. When intervening in real-life settings, changes and uncertainties make difficult to isolate variables to observe and control experimental conditions. Yin defines four critical conditions which can be encountered in demonstration projects and evaluation in real life settings:

- Midstream changes
- Changes in participation
- Poor retention and high attrition
- Differences in professional systems and goals.

Yin describes four main evaluation study methods: Case study evaluation, ethnographic evaluations, grounded theory and standard quasi-experimental evaluations (Yin '81; Yin '92; Yin '94). Case study evaluations are empirical

enquiries that include the context (social, procedural, environmental context etc) when investigating the phenomenon that is object of the study. This is a particularly important aspect for this research because it allows monitoring of both the implementation and the intervention process. Indeed, in real participatory planning activities, the boundaries between context and phenomenon are often not clear. Participatory planning processes are social processes that involve the surrounding social context in which they take place in many different ways. At any moment of the process, elements of the context can exert an active role in the process, becoming process 'agents' (active elements of the process). Thereby it is difficult (if not impossible) to distinguish between elements of the context and elements of the phenomenon. Furthermore because of the complexity of the cases, multiple sources of evidence need to be used from both qualitative and quantitative data. Finally, case study evaluations can be used both for exploratory studies that aim to develop new hypothesis, and to assess results or verify and test hypothesis. All these characteristics make the case study method the most suitable for our purposes.

Evaluation is organized in two evaluation studies that aim at testing the two main activities related to the construction and the exploration of the planning process memory. As detailed in section 5.5 the planning process memory system needs to be first of all used and populated from the knowledge manager in order to build the planning process memory/history. Ones the process memory has been constructed or reconstructed (post-hoc) a different kind of activities of system exploration and project analysis can be performed both form planners and form other stakeholders involved in the planning process. The two evaluation studies aims at testing these two 'memory' practices.

The main result of the evaluation studies is the description of a set of tools and method to acquire, represent, manage and exchange knowledge in different case studies at different planning scale.

7.1.1 The First Evaluation Study: Testing Memory Building Activities

The first evaluation study is an exploratory study that aims at testing memory-building activities. That is, testing the designed memory platform in the different activities of capturing and representation of deliberation in real planning projects. This evaluation study explores the technical process of using the tools to capture and represent the process memory.

Thereby it consists in testing the activities that a planner should perform to capture and represent the project history, that is to say to build the process memory.

Real examples of the process planner should go through to use the platform tools are presented, which have been applied in different planning phases and cases. The main objective is to produce a kind of "planner's handbook" of the memory platform and tools in different planning cases, giving real application examples. Different case studies have been used to test the process of capturing and representation of a planning process at different scales, process phases and in different environments. Each case has been organized according to the following factors:

- Phase of the planning process to capture/represent

- Time of capturing (live or post-hoc analysis)
- Meeting environment (on-line, face-to-face)
- Information resources used

The three tools of the platform (Compendium FM and CoPe_it!) have been tested in different case study.

The second outcome of the first evaluation case is a critical analysis of the difficulties and limitation of the described applications. From the analysis of the evaluation results a new ideal process memory platform has been envisioned and it will be discussed in chapter 11.

7.1.2 The Second Evaluation Study: Testing Memory Exploration Activities

As described in section 7.1 the second evaluation study aims at testing a specific research hypothesis, that is to say testing Compendium and the applied information architecture (see chapter 6) as process memory. In order to do so, we need to test users experiences in exploring the process memory system and extracting useful information from it.

For this objective an evaluation study has been conducted involving different kind of users. Some of the case studies used for the first testing activities have been used for the user interface evaluation. They have been chosen in particular for opportunistic reasons, because the stakeholders were available to participate or because the planning process at stake was still on going. Users have been asked to both evaluate the system's ease of use and to evaluate the system capability to support them in a certain number of tasks. Each of these tasks has been designed to ask for specific knowledge to be extracted form the system. Thereby users performed several actions of knowledge extraction and use and then they had to judge how easy/difficult the task was, and how adequately the system assisted them in accomplishing the task. The next chapter details the methodology and tools used in this evaluation study.

The evaluation projects were conducted in three phases: Evaluation design, data collection and analysis, evaluation reporting. In the following sections we describes the case studies framework explaining for each case system features it intends to test and research questions it want to address.

7.1.3 Evaluation Design

As discussed, a Multiple Case Study Method was used to test different aspects of the memory platform. We conducted six case studies, which will be referred in the following with an acronym as described in the table below (Table 7-1).

Table 7-1: Case Studies Acronyms

San Pietro Piturno – SPP
Torre Guaceto Natural Reserve – TG
Campi Salentina –CS
Milton Keynes Master Plan – MK
Parco Agrario degli ulivi – PAU
Strategic Plan of Bari – SPB

Each of these cases has been used to test one or more of the components of the platform (Compendium, FM and CoPe_it!). The figure below shows which of the tools have been tested in each different case (Figure 7-1).

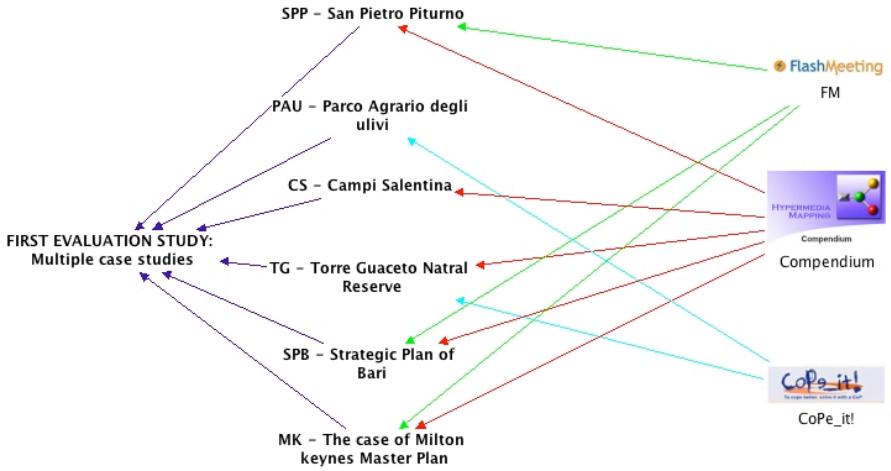

Figure 7-1: Platform Tools Tested in Different Case Studies

As we can see, Compendium is the core system of the platform and it has been tested in 5 out of six case studies. The only case in which it was not used is the PAU case, which has been specifically designed to test CoPe_it! as a tool for synchronous, on-line dialogue and argumentation.

Each of the other case studies have been used to test at least two of the platform tools either separately or in a combined application, testing the functionalities made available by the integration between the tools (see the integration projects, section 6.6.2).

In the phase of evaluation design we consider the big picture of the evaluation study: why we chose the case, which tools have been tested and explaining how the single case contributes to the platform evaluation study.

In contrast, in the data collection and analysis phase, our evaluation narrative will follow case by case. We describe each case, giving a brief introduction of the planning project, and explaining in detail the data collection activities performed.

Finally for the evaluation reporting we revisit the wider evaluation framework (see Table 7-3 described in section 7.2) discussing how the results of each case contribute to the evaluation of the platform, that is to say considering again the big picture of the multiple cases and discussing evaluation results.

7.2 Evaluation Framework

The evaluation framework will be described through two tables. The first describes the objectives of each case study, in relation to the thesis Research Questions. The second table describes how each tool has been tested in the different cases to accomplish the objectives.

In the first table all the objectives represent functions that the memory platform aims to achieve, and how they were tested in the different case studies (Table 7-2).

Table 7-2: Case Studies Objectives

Case study	Objective
SPP	Reconstruct and represent the deliberation process
SPP	Reconstruct and represent the design rationale
TG	Tracking and representing the project memory in real time
TG	Reconstruct and represent the entire project memory
CS	Reconstruct and represent spatial argumentation
MK	Video annotation of face-to-face meetings on the fly
PAU	At distance synchronous and asynchronous argumentative discussions
SPB	Video annotation of face-to-face meetings on the fly

As we can see the first three case studies aim to reconstruct and represent process memory within Compendium. Different techniques, tools and methods have been used to accomplish these tasks. Compendium, FM and CoPe_it! provide facilities for video annotation, note keeping and story telling to reconstruct process memory. The last three cases, in contrast, focus specifically on testing FM and CoPe_it!, with the main aim to test the tools' expressive capabilities and ease of use in real planning cases.

In the second table below we finally specify what tools of the platform have been tested and how in the different case studies. Compendium has been used in 5 case studies out of six. In all case studies at least two tools have been tested, with the exception of:

- CS case study, in which we tested Compendium for reconstruction and representation of design rationale, and
- PAU case study, which has been designed ad-hoc to test and evaluate the use of CoPe_it! in real planning conversations.

FM is always been tested together with Compendium, focusing on Compendium-FM integration features.

Table 7-3: Evaluation Framework - Tools of the Memory Platform Tested in Each Case Study

	Compendium	FM	CoPe_it!
San Pietro Piturno	Compendium used to store the expert inquiry results and to build knowledge classification templates.	FM used for life annotation of meeting videos	
Torre Guaceto Natural Reserve	Compendium used as multimedia project memory		CoPe_it! used directly form the community to discuss at distance
Campi Salentina	Compendium used to trace design rationale: testing the Memory system capability to support spatial design activities		
Milton Keynes Master Plan	Compendium used for taking notes during the meeting. Furthermore enriched with all the different multimedia source of information and data produced and/or exchanged during the process	FM used for multiple authored annotation: supporting participants contribution analysis	
PAU Parco Agrario degli ulivi			CoPe_it! used in a planning experts application both as argumentation environment and collaborative KMS
Strategic Plan of Bari	Compendium used for taking notes during the meeting. Furthermore enriched with all the different multimedia source of information and data produced and/or exchanged during the process	FM used both for annotating who spoke when, to take notes of relevant issues, contributions raised during the meeting	

Observing the aggregation of the case study characteristics (see Table 7-4 it is possible to see that the memory platform has been used for memory building activities in a wide range of participatory planning process phases: consultation meetings, interest group meetings, team group meetings and design meetings. Each of these was traced with different methods and tools according to the meeting peculiarities (topics, number of participants, aims of the meeting etc). Both large-scale meetings and small group meetings have been studied and different ways of capturing planning deliberation have been tested. Also, both face-to-face real world meetings and on-line meetings have been studied.

Table 7-4: Case Studies Characteristics

CASE STUDY	Phase of the PP	Time of capturing	Meeting environment	Information resources
SPP – San Pietro Piturno	Consultation meetings	Post hoc, trough analysis of the video replay	Real-life, face-to-face meetings.	Videos and actors interviews
TG - Torre Guaceto case study	Community Groups Meetings	On going phase	Real-life, face-to-face meetings and on-line	Life-meeting participation, meeting videos, audio records, and actors' interviews
CS – Campi Salentina case study	Technical design meetings	On going phase	Real-life, face-to-face meetings.	Life-meeting participation, meetings audio records, and actors' interviews
MK –Milton Keynes Master Plan	Team group meeting	On going phase	Real-life, face-to-face meetings.	Life-meeting participation, meeting videos, screen cast, note keeping maps
PAU – Parco Agrario degli Ulivi	Team group meeting	Post-hoc simulation, at distance asynchronous interaction	On-line	Meeting transcripts
SPB – Strategic Plan of Bari	Consultation meetings	Life, on going phase	Real-life, face-to-face meetings.	Life-meeting participation, meeting videos, note keeping maps, meeting notes form the planning team

In chapter 7 we describe the results of application of the memory platform tools in the five case studies (TG, CS, MK, PSB, PAU). These cases have been grouped because they are part of the first evaluation study.

As SPP is our main case study, we dedicate an entire chapter to it (Chapter 9) SPP is our main case study for two main reasons: it is the case on which we designed the information architecture for capturing deliberation in participatory planning practice, and it is the case in which we tested and evaluated most fully both the information architecture and the Compendium tool at the core of the memory platform.

In Chapter 10 we conduct the second evaluation study to test the information architecture and the use of Compendium as a process memory interface. This evaluation study aims at testing exploration activities of the memory system by the users. We want to test users-system interactions and in particular the users experiences in exploring the process memory system for extracting useful information from it. The SPP applications described in Chapter 9 will be the focus of this work in the evaluation study.

7.3 Introduction to the Case Studies

We now introduce each case study conveying why we chose the case, which tools have been tested and how the case contributes to the platform evaluation study.

7.3.1 SPP – San Pietro Piturno Case Study

SPP is our main case study, focusing on neighbourhood regeneration in a small municipality in the south of Italy (Putignano, Puglia Region). We chose this case firstly because we had available the complete video materials of the consultation process within the regeneration planning process. In addition, the non-profit organization (ISF, Engineers Without Frontiers) involved in the participatory process made its data available to evaluate the case study results, together with its planners involved in the planning process at institutional level. Thereby the case has been considered of high value, both because of the stored multimedia information about the planning project and because of the human resources made available for the evaluation phase.

In this case we tested the system capability to capture and represent a consultation process with the SPP local community. When we started our case study the SPP project was already ended. Therefore the case study consisted in a post hoc reconstruction of the process memory. We had two main aims:

1. Testing the memory platform capability to reconstruct the deliberation process and
2. Testing the memory platform capability to reconstruct the design rationale.

To accomplish the first objective we did a post hoc analysis of the videos of the meetings with the local community. FM, Compendium and their integration features were tested jointly to build a process memory for the deliberation process carried out in SPP. As we will show in the following chapter where we analyze the case study in detail, this is the case in which the knowledge structure and knowledge object taxonomy has been applied and evaluated with the community, directly engaging them in the process memory system exploration.

To accomplish the second objective, two interviews were conducted with the coordinator of the SPP project, in order to reconstruct the design rationale, identifying the main design decisions and understanding the reasons behind those decisions. This was an attempt to reconstruct the design rationale through a single authored story telling experience. The main aim here was to understand what knowledge was "remembered" from the interviewees and if this knowledge shared by the other project participants? What knowledge was actually missing in the story? And why?

Table 7-5: SPP Case Characteristics

SPP – San Pietro Piturno case study
Phase of the PP: Consultation
Time of capturing: Post hoc, through analysis of the video replay
Meeting environment: real-life, face-to-face meetings.
Information resources: video, and participant interviews

7.3.2 TG - Torre Guaceto Case Study

TG case study is not about a conventional planning activity but concerns the activities performed by a community of farmers to enhance their biological production income. In this case the planning team was in charge of helping this community of practice to build their past and present project history. Therefore, the system was used both to rebuild and represent the past history of the community and to capture and represent the new, ongoing activities. It aims at testing the system capability to capture a deliberation process in the ongoing phase and at testing new way to reconstruct and represent the history of a project through single authored story telling activities.

We chose this case study because this was still running; this gave us a good occasion to do some live testing of process memory building activities. Furthermore this case involved a real farming community of practice, providing the opportunity to investigate process memory building and tracing activities outside an institutional environment, where we could better appreciate the differences and difficulties of working with local communities, in their environments and with their communication protocols.

Table 7-6: TG Case Characteristics

TG - Torre Guaceto case study
Phase of the PP: Community of Practice Meetings
Time of capturing: ongoing phase
Meeting environment: real-life, face-to-face meetings.
Information resources: live-meeting participation, meeting videos, audio records, and participant interviews

7.3.3 CS – Campi Salentina

CS case study is a prototypical planning case of design of a Master Plan for a small town in the south of Italy (Campi Salentina, Puglia Region). In this case we wanted to observe technical meetings of the planning team. The aim of the case study was to participate and observe these meetings trying to monitor design decisions and trying to track and represent the design rationale. The project consisted of the drawing up of the master plan for Campi Salentina, with planning decisions consisting mainly in drawing maps and norms for the land use. While in other cases the planning discourse concerned deliberation about problems, options and social implication of policy making, in this case deliberation within the planning team have a particular interest in the spatial objects (land, buildings, roads etc.) or in the wider impact and implication of spatial choices. The design itself evolves with the changing of shapes and lines in the map. Thus, in this case study we tested the capability of the memory platform to manage and represent spatial argumentation, and spatial evolutions of the land use maps.

We chose this case because it offered a view on the problem of tracing planning process memory, which was oriented to trace the effects of deliberation activities on the spatial design practice.

Table 7-7: CS Case Characteristics

CS – Campi Salentina case study
Phase of the PP: Technical design phase
Time of capturing: on going phase
Meeting environment: real-life, face-to-face meetings.
Information resources: life-meeting participation, meetings audio records, and participant interviews

7.3.4 MK - The Case of Milton Keynes Master Plan

MK case study is quasi-naturalistic case study conducted with a group of citizens in Milton Keynes (UK) in which they were discussing the Milton Keynes Master Plan that shaped the new city in the 1970s, and future lines of development for the city. The aim of this case was to test video annotation of face-to-face meetings, in the ongoing phase. The specific case regards consultation meetings or technical team meetings in which participation is limited to small number of known people. In this case, since the annotation is live we can track planning conversations minimizing the work to be done after the meeting, and since participants are known in advance, we can maximize the annotation results by indexing contributions by participant. In the next chapter we describe the annotation procedure, showing how this aims at both enriching the participation analysis and the transparency of the process memory results.

This case has been built to test the use of FM for video annotation in face-to-face meetings. The planning topic was chosen for opportunistic reasons. First of all because Milton Keynes Master Plan is a topic of interest in the planning domain and a prototypical case for planning scholars, second because being Milton Keynes citizens, the participants held a real stake into the discussion. Furthermore, the participants included an officer who worked in the Milton Keynes Development Corporation during the 1970s, who enriched the discussion with real knowledge and direct experiences about the planning process and its development.

Table 7-8: MK Case Characteristics

MK – The case of Milton Keynes Master Plan
Phase of the PP: Team group meeting
Time of capturing: on going phase
Meeting environment: real-life, face-to-face meetings.
Information resources: life-meeting participation, meeting videos, screen cast, note keeping maps

7.3.5 PAU - Parco Agrario degli Ulivi

The PAU case study concerns the activities of the PAU Community of Practice. The community objective is to stop the uprooting of thousands-years olive oil trees in the south of Italy by defending the area as a Natural Park Area. We chose this case because it involved a real Community of Practice in a real planning case, providing through simulated online re-enactment of that discussion, the opportunity to test the CoPe_it! tool. Participants of the community in a face-to-face meeting conducted a real discussion. Meeting dialogues were audio recorded and transcribed. The transcripts were been used by three people (a researcher, a

PhD student and a masters student). They role-played on-line via CoPe-it! three participants of the PAU community during a face-to-face discussion. This case tested CoPe_it!'s usability for synchronous, distance argumentation, in order to understand advantages/disadvantages of using the tool in planning discourse.

Table 7-9: PAU Case Characteristics

PAU – Parco Agrario degli Ulivi case study
Phase of the PP: Team group meeting
Time of capturing: post-hoc simulation, at distance asynchronous interaction
Meeting environment: on-line
Information resources: meeting transcripts

7.3.6 SPB - Strategic Plan of Bari

This case study is built around upon the case of drawing up the Strategic Plan for the metropolitan area of Bari. This is an extensive planning case extended to a metropolitan area of 1.400.000 inhabitants and 31 municipalities. The strategic plan for the metropolitan area of Bari has been conducted involving numerous institutional and non-institutional organizations and expertise to discuss problems, resources and possible future lines of development for the metropolitan area. The project has seen extensive human and economic resources invested in the drawing of the strategic plan. Our objective is not to discuss or revise the planning process itself. We describe a small case study to test innovative ways to the ones used by the research group involved in the plan, to represent the planning conversations raised in the consultation phase. The consultation phase consisted of 19th theme meetings with different groups of domain experts. We participated in the meetings and applied two different forms of information and knowledge capture: note taking with Compendium and live video-annotation with FM. The meetings results were organized in Compendium maps, compared with the original notes taken by the meeting group, and published on the website. This case was chosen first of all for the relevance and impact of the case itself at city level. Secondly, because the consultation meetings received a high degree of technical support, with the assistance of the strategic plan's research group, we had access to the all the video materials of the participatory phase meetings, a high value database for present and future evaluation plans. A third reason for choosing the case is that, since the planning team worked in parallel with our research, for three of the 12 consultation meetings, a comparative analysis has been conducted between the planning team's meeting records, and the new ways that we are devising to capture meetings.

Table 7-10: SPB Case Characteristics

SPB – Strategic Plan of Bari case study
Phase of the PP: Consultation meetings
Time of capturing: live, on going phase
Meeting environment: face-to-face
Information resources: live-meeting participation, meeting videos, note taking Compendium maps, meeting notes from the planning team

8 Testing Memory Building Activities: The First Five Cases (TG-CS-MK-PAU-SPB)

This chapter describes results of memory building activities in five case studies. For memory building activities we mean the activities a planner needs to perform to construct or reconstruct the process-memory. These activities are: capturing, structuring and representation of information and knowledge in a way that captures planning process evolution in multiple contexts. We will describe different memory building methods adopted in different situations, discussing advantages and disadvantages of methods, and success failure of the different applications.

In this chapter we apply different methods and tools to trace the planning process evolution in terms of information and knowledge generation and exchange between stakeholders involved in the process. Tracing knowledge generation and exchange asks for different techniques and tools that need to be calibrate with the specific planning tasks that the stakeholders are accomplishing, with the stakeholders background, with the group objectives and with the mediums and environments in which information and knowledge are constructed and exchanges. The five cases show how the process memory can be captured, structured and represented (three activities that we defined as memory building activities): i. in different phases of a planning process, ii. in different time of capturing, iii. in different meetings environments and iv. using different information sources and resources (see Table 7-4 to compare the different cases). In the final section we discuss the results of the memory building activities proposing specific methods and tools for different planning scenarios.

8.1 TG - Torre Guaceto Natural Reserve: Assisting a Community of Agriculture to Enhance Biological Production

As previously described in section 7.3.2, TG case study is not a conventional planning case, it is built around a community of practices composed of heterogeneous group of stakeholders (a community of farmers, NGOs, local agencies etc) that emerged around the shared goals to enhance the biological production in a agricultural area in the south of Italy (Puglia region, Brindisi province) called Torre Guaceto. The main goal of the farmer group was to build a repository of best practices to be used to inform potential customers about the agricultural production and its biological value, then hopefully enhancing the sales of the TG local products. The main for them was to increase the profit gained from the biological production. On the other hand other project partners were more concerned about the quality of the product and of the biological production in term of environmental protection. In particular several local agencies (such as Torre Guaceto Park Agency, Liberaterra, Slow Food etc) were involved in the project

each one for accomplishing different tasks like coordinating the activities, commercialization of products, implementation of pilot cultivation projects etc. In this scenario the planning team was in charge of helping the TG community of practice to build their past and present project history. Thereby the memory platform and its tools (Compendium FM and CoPe_it!) have been used both to rebuild and represent the past history of the community and to capture and represent the new on going activities. In order to rebuild the past experiences we performed different activities: we did a press review of all the articles written about the TG community activities in the last 4 years of activities. All the journal paper were collected in the archive of the Torre Guaceto Park Agency, piled up and mixed with all the journal papers about the TG Park activities. The press articles have been grouped and scanned, so that they could be added in electronic format to the hypermedia database (Compendium). The press review wasn't actually more then a list of relevant events as described form the journals. Just a very small part of the community of practice history could be reconstruct in this way. Thereby we decided to drive three semi-structured interview with one of the key actor of the community. He is one of the farmers but at the same time he is a consultant for the TG park agency with a background in agricultural engineering. Because of these different expertise and the overlapping roles he played in the community he has always been a key actors in the project. He was able to monitor and reconstruct the salient events of the project at different levels (at the level of community of farmers and at the level of local agency activities). Thereby he has been chosen as key actor to reconstruct and represent the history of the TG community and the activities performed during the years starting from the community institution. Two interviews have been driven to reconstruct the history of the olive oil production and a second one to explain the evolution to the new biological production of the chopped tomato. These are the two core activities of the communities of farmers. A part the two interviews we have also traced two face-to-face meeting with the community of farmers. We have audio recorded the videos and then transcribed, annotate and structured the contents in the Torre Guageto (TG) memory project. Moreover two meetings of the TG project team have been audio recorded and represented with the same annotation criteria. The last methods of gathering information have been by video recorded interviews with FM. In particular the history of the chopped tomato have been reconstructed analysing the FM video and then transcribing the contents in Compendium.

We have also tried to use FM to video annotate life one of the meeting with the farmers but we failed. In fact these meeting were very informal, it was even difficult to establish when the meeting had started. People use to talk separately in small groups. Decisions are taken in these small groups without a general agreement of the group. Decisions are delegated to different individuals in the community that are considered experts in certain fields and thereby have the 'trust' from the other members. The community members behave in a very messy and unstructured ways; thereby t is very difficult to apply any king of pre-arranged procedure to track the meeting contents. The issues are decided on the fly and it is even difficult to know what is going to be discussed. This uncertainty made even more complicate the memory tracing activities.

8.1.1 Results of the Memory Building Activities

This case study aims at testing the system capability to capture a deliberation process in the on going phase and at testing new way to reconstruct and represent the history of a project through single authored story telling activities.

We captured the on going process by two methods: note keeping in Compendium and audio recording of the meetings: two meetings with the community of farmers and two meetings with the planning team.

Moreover we traced two interviews to one of the key actors in order to reconstruct the history of two agricultural production of the community of farmer: olive oil and chop tomato production. Two techniques have been used: i. audio recording of the interviews and ii. video recording with FM, then reconstructing afterword the issue map of the story telling of the interviewee.

The results of these memory-building activities have then been organized in the TG community memory project. The contents have been organized as to be published on the TG website. Thereby a first home page introduces the community, the TG natural reserve, the objective of the community of farmer etc. Then a hyperlink connect the home view to the contents of the community activities (Figure 8-1). This is the hyperlink, which connects to the TG process memory contents.

The TG process memory contents are organized in five views, shown in Figure 8-2:

- Actor's view
- Meetings' Contents view
- Summary of Decisions view
- Press Clippings view
- History of Agricultural Productions view

Four of the five knowledge dimensions described in section 3.4 (Conceptual /argumentative, Social view, Temporal view and Project Oriented view) has been represented, exception made for the spatial view. This result is grounded on the analysis of the meeting contents. We transcribed and classified the statements raised by the stakeholders during the planning conversations. None of this was actually directly referred to any specific geographical area. During the meetings they never used any map or cartographic bas to discuss of specific problems. The issues addressed by the TG community were organizational issues like: how to organize the work, when to start to harvest, who will be the first agriculture to use the oil jerry cans, etc. The reason for that can be that the community of farmer is composed of people living and working the TG land since generations (indeed, the most of land owners come from the same three families). Thereby they know the land perfectly, they do not need a map to understand each other and to explain geographical issues. All of them know the precise extension, locations and even character of the land property of the other farmers. Thereby the spatial dimension it is like disappearing in their communications.

Thereby a spatial representation of the TG area is shown as the background of the home view, in which the area and the community is described; but a part that we did not represent a view for spatial argumentation.

Figure 8-1: TG Home and Community's Activities View

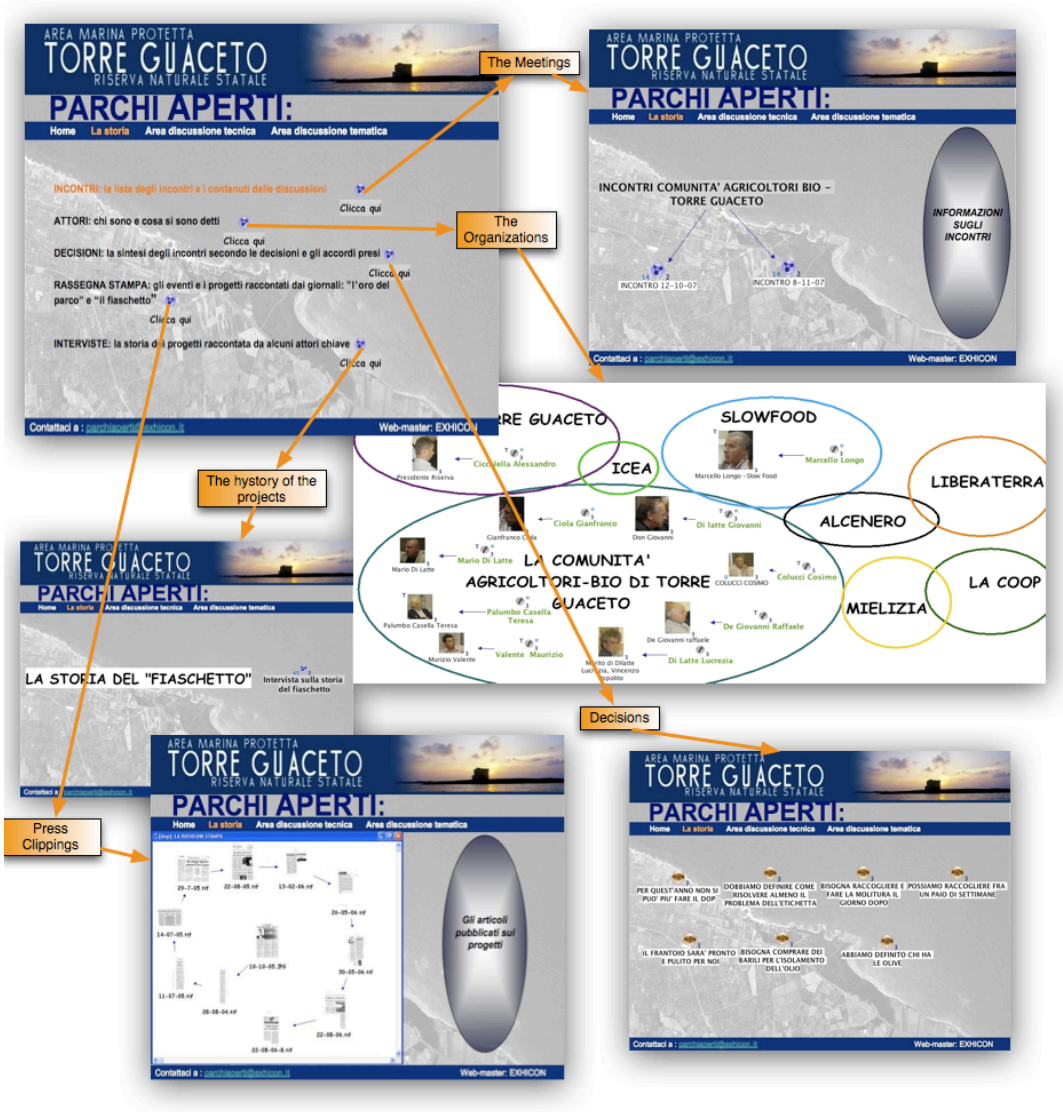

Figure 8-2: TG Process Memory Views

The social view shows the organizations involved in TG community activities. Each organization is represented as in a set, and each participant is associated to her name and picture. By clicking on the author icons it is possible to access general info of the participant.

The summary of decisions view is the instantiation of the Project-Oriented dimension. It shows the list of all the decisions taken in all the meetings by the TG community. By clicking on the decision node is then possible to access the actual discussion in which the decision has been taken.

The Temporal dimension is instantiated with two different views: the history of the agricultural productions and the press clipping view.

The press clipping view represent as in a temporal spiral all the articles published about the TG community activities in the local journals in the last four years (see Figure 8-2). The history of the agricultural productions is the view that has been

built as a result of the single story telling experiences with one of the key actors (Figure 8-3).

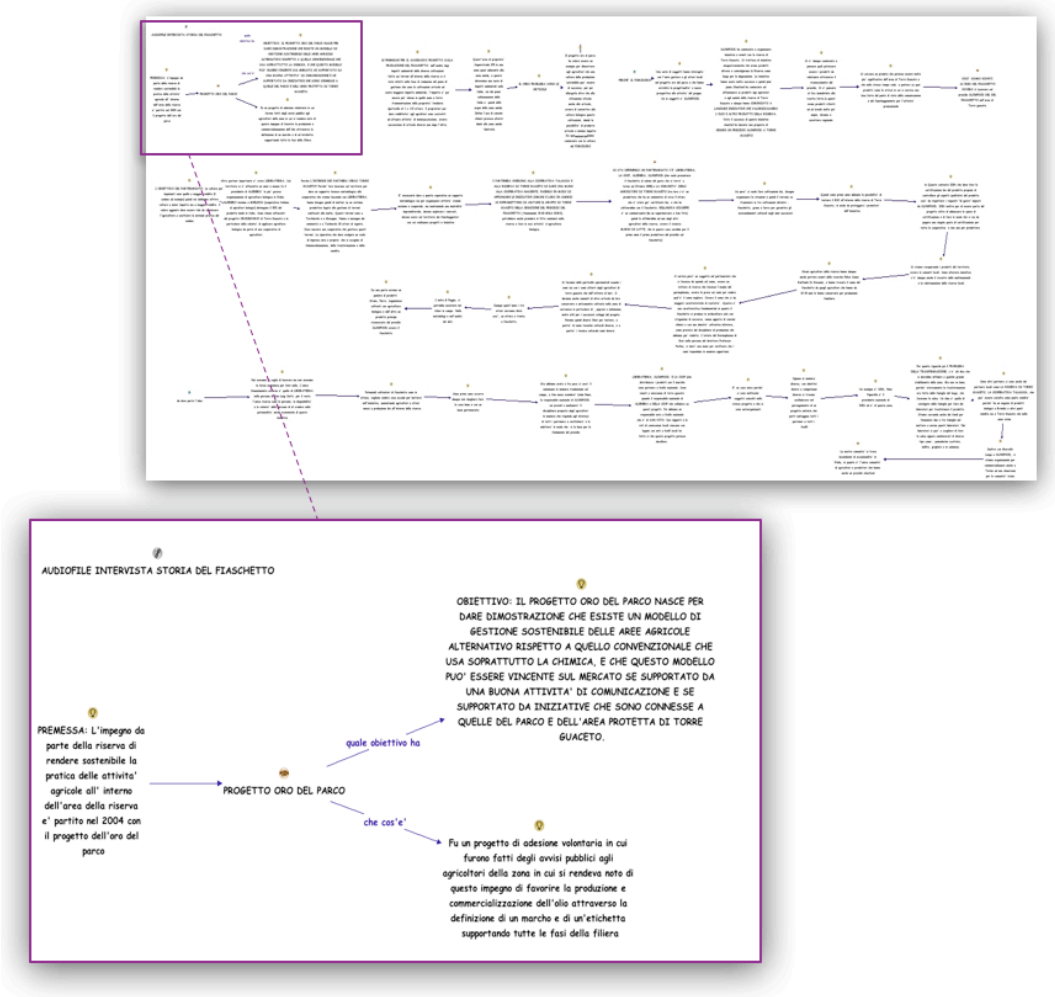

Figure 8-3: Results of the Storytelling

Figure 8-3 shows the result of the story telling. As we can see the statements are actually entire paragraphs including more then one claims. Every paragraph represents a unique concept like i.e. the description of an event or a decision taken. Concepts follow one after the other as the temporal thread of the story goes on. The final representation is like an enormous snake of almost undistinguished nodes. Just when the narrative introduces a key event or decision a 'decision' icon is associated to the concept. A part that the representation is pour, difficult to follow and if doesn't actually give any additional benefit to the communication and understanding of contents. On the contrary it looks like less intuitive and familiar of a simple text page. Thereby we can conclude that as a results of our testing that the concept mapping looks like been of poor results if what is represented is not a discussion between more then one uttering but it is a single story telling experience.

Stories are often narrated sequence of events arranged chronologically. Even when the narrated facts are not historically in sequence the story refers to the actual chronology of events in the specific narrative. Thereby it is always a sequence of

concepts made into a plot, and the understanding of the plot is possible just following exactly the chronological sequence of the statements. Mapping concepts breaks the links of the narration, thus making more difficult to read and understand the story. It is our consideration that these storytelling experiences are better represented as texts, or audio and video records more then broken in fragments.

Finally we have the Conceptual/Argumentative dimension which is instantiated with a set of nested views described in the following. Figure 8-4 shows that starting from the Meetings view it is possible to access the view of the list of the meetings. Then clicking on the node of one of the meeting we reach the view describing the single meeting contents. The Views provide general news on the meeting (i.e. where and when have been hold, who participated, what was the meeting topic) then specific info on meeting contents and discussions can be reached clicking on the icon "meeting contents".

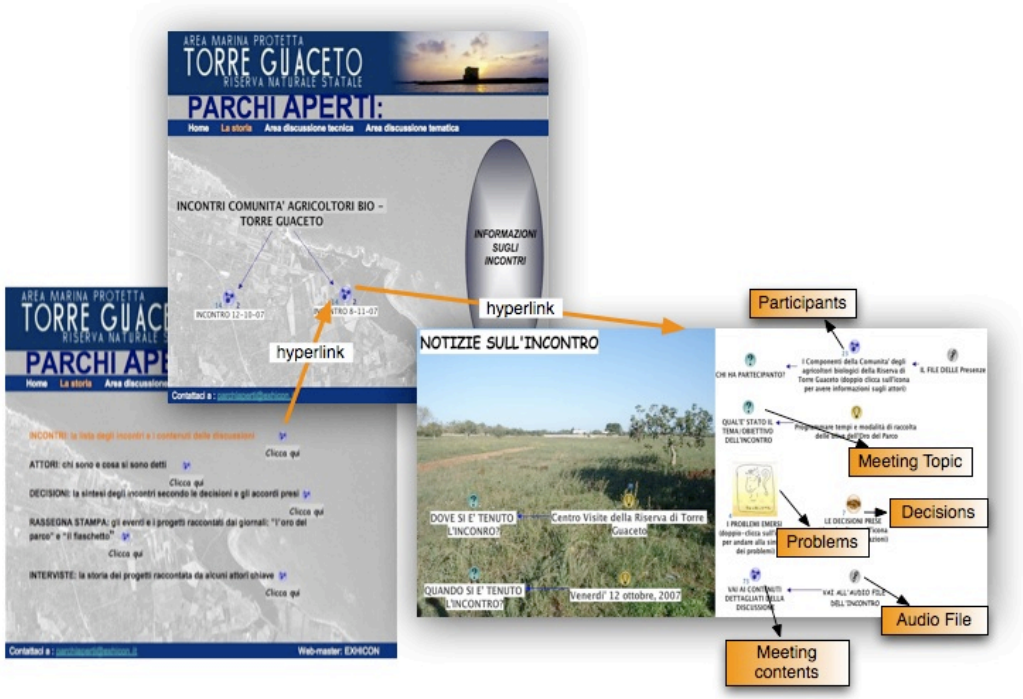

Figure 8-4: Hyperlinks to the View of a Meeting

By clicking the node "Participants" in the view of a meeting (Figure 8-4), we access the view of the list of participants. As in the Organizational view, by clicking on participants' picture we can access personal info on the person (Figure 8-5).

Figure 8-5: 'Participants" View

Moreover by clicking on the node “meeting contents” we can access the contents of dialogues and deliberation held during the meetings. Figure 8-6 shows an extract of a discussion. Dialogues are structured with an Issue-Based Information System (IBIS) model. IBIS is an argumentation model distinguishing between issues, positions on these issues, and arguments pro and con these positions (Kunz and Rittel 1970). As we can see in Figure 8-6 some idea/answer nodes have been personalized with a different icon, in order to specify that some idea/answer nodes are actually expression of specific open issues to address. Moreover, each statement has been associated to the person who raised the statement. The IBIS link types (like oppose to, answer to etc) have been used to explain relationships between the statements as occurred in the meeting dialogue.

Finally a view of summary of meetings has been given, listing in two different views the problems raised and the decisions taken by the community during the meeting (Figure 8-7).

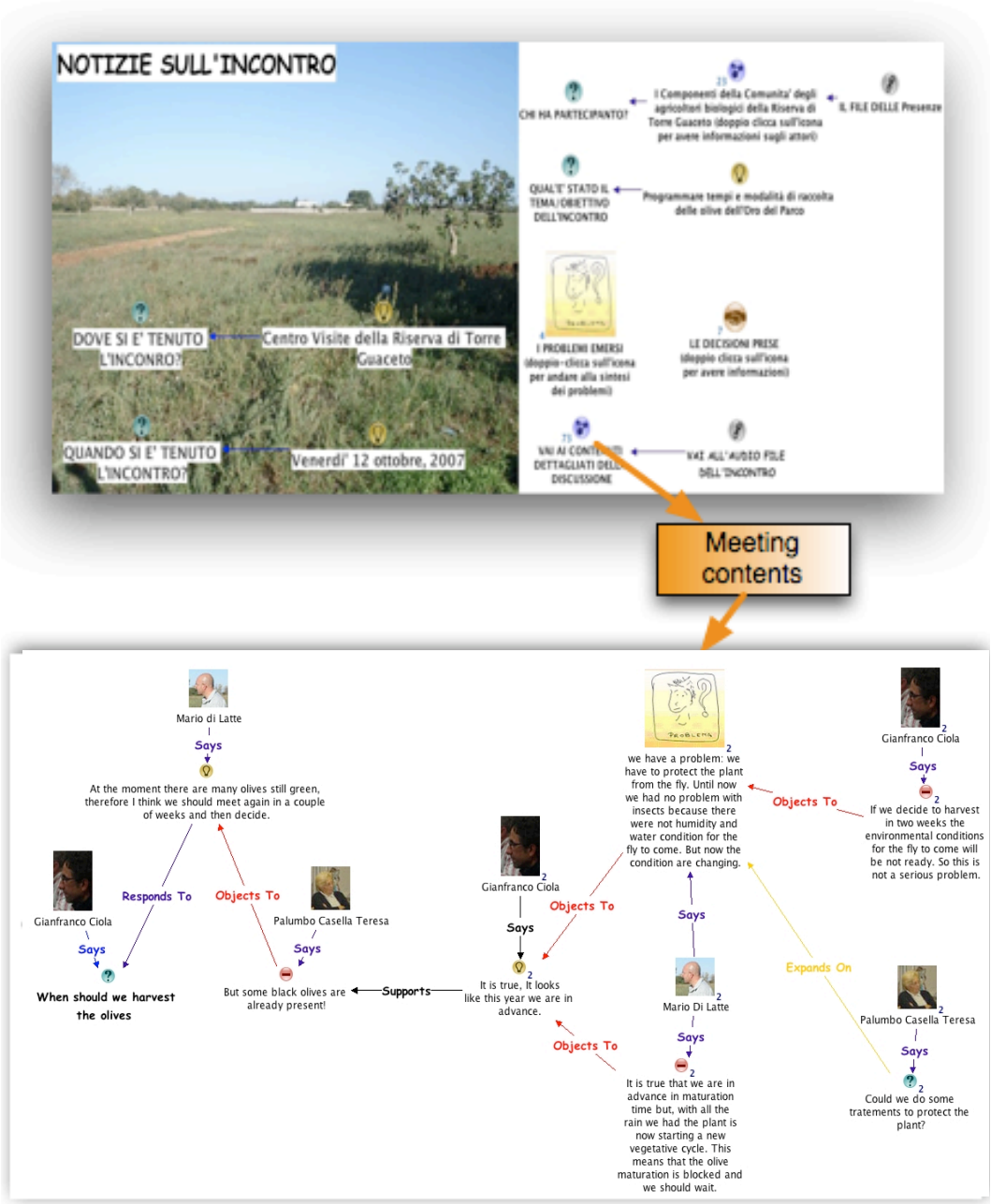

Figure 8-6: View Describing Meeting Discussions with an IBIS Model

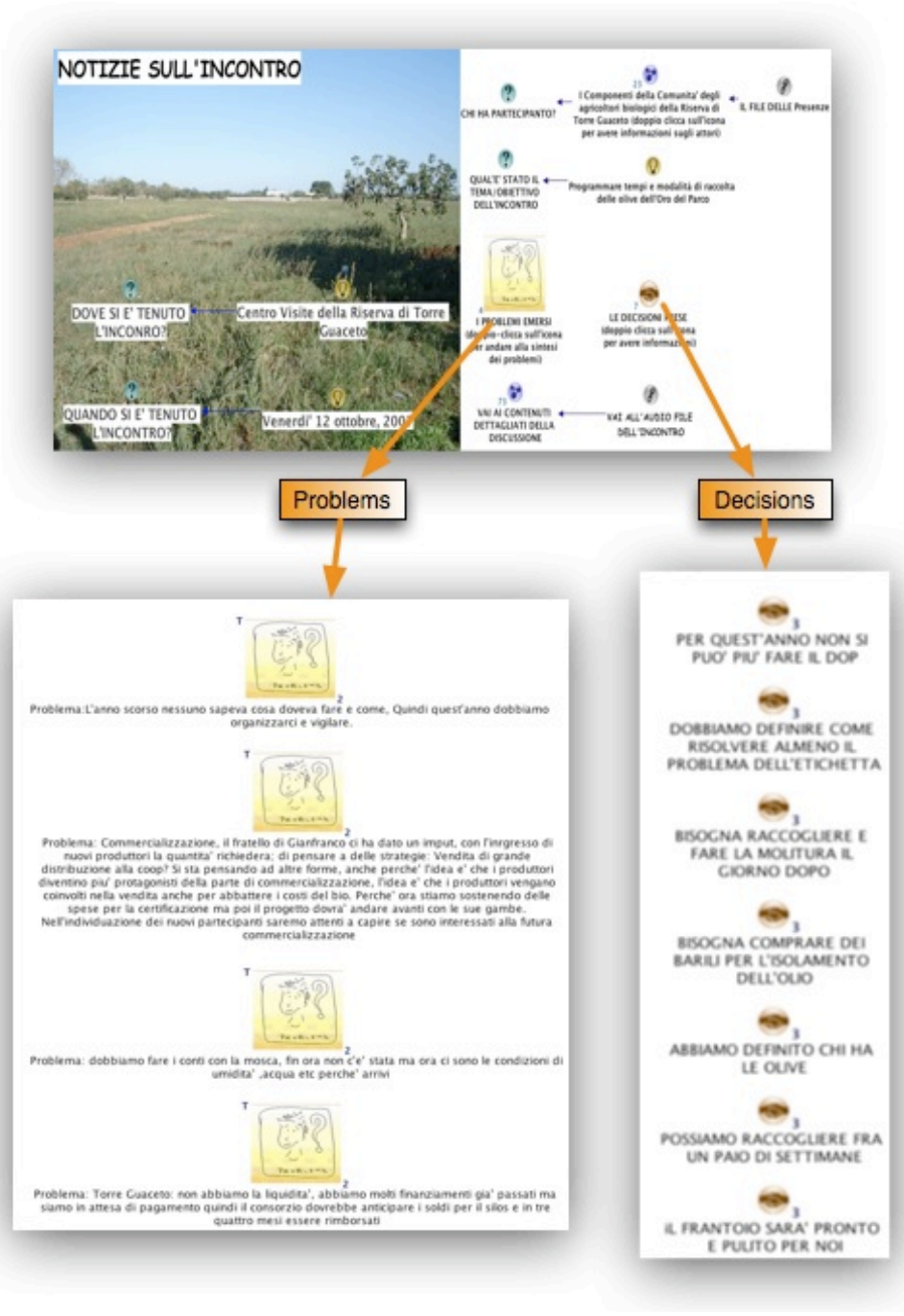

Figure 8-7: Views of Summary of Open Issues and Decisions

8.1.2 Discussion

This case study have been driven for testing the system ability to represent and structure contents of a collaborative-process memory along his real time development. As a first step in the phase of Case Study design we have defined a hypothesized understanding of the collaborative process to be tracked by the memory system Specific attention has been put to the organizational and social context in which the process would occur.

The TG participatory process involves an unstructured and self-organizing community of farmers. In this community organization members follow an 'at need' process logic in which actions are designed and implemented at need, that is to say when contextual conditions and occurrences make an action necessary. In such an organization it is difficult to foresee what information and knowledge will be used and generated because the process steps are decided on going and information and knowledge are generated when they happen to be necessary. Therefore for the evaluation phase we have focused on meeting types and contents. We have analyze them post-hoc making sense of what happened, what information and knowledge have been put in action and why. We have paid attention to the stakeholders involved and to the meeting modalities more then on the specific contents and objective of the meetings which remained variables and difficult to forecast. We hypothesize the contextual conditions in which the meetings would have operated following the knowledge object taxonomy of which at section 3.4.

As discussed in the previous section the only omitted representation is the spatial one, because this was not representative of the data on which we grounded our representation of the process memory.

The main outcome of the case study is that we tested the memory system application in a real case study, we represented information and knowledge objects extracted by community deliberations and we represented them in their different contexts.

We gave an example of how we can use the memory platform to reconstruct the decision rationale, by connecting decisions to the knowledge sources which explain and/or have been used to reach that decision. In order to produce this process representation we collected different kind of data: mainly claims, images, and narration of facts, audio files and pictures. All these are knowledge objects, and are represented in the system as node in a graph like structure. Every node in a graph has a label, an icon and a textual content. All these base features are customizable (as we shown in the case of the 'open issues nodes', see Figure 8-6). A part this a node can have several contextual dimensions, it can be associate to multiple tags, it can be connected to multiple nodes with different links type, and it can be hyperlinked to any kind of reference file.

All this features will be described and applied in further details in sections 9.4 and 9.5 were the annotation scheme and the information architecture have been described in details in the application build within SPP case study. Even though following slightly different information architecture, the memory system is consisting of four contextual dimensions: the social, the argumentative, the temporal and the project oriented dimension. These dimensions are four contents exploration interfaces each for every relevant knowledge context to be monitored in the case study.

In this pilot study we tested the system ability to represent the preliminary 4 dimensions that are key knowledge context to represent claims expressed in the argumentative dialogues both in Consultation Meetings and Technical Meetings of the planning team.

All the represented knowledge objects have been either extracted by meeting discussions, or alternatively they have been reconstructed post-hoc as the results of story telling experiences with key actors in the decision-making process.

In particular this post-hoc reconstruction did not promising results. The storytelling experiences do not seems to be fitting with an issue mapping representation rules. Other multimedia and capturing methods like text, video and audio record seems to be more suitable to communicate contents of stories and narratives.

Moreover this was a case study driven in order to test memory building activities performed by the planning team to tract and reconstruct the process memory, but no evaluation have been given of the quality of the representation. Obviously this narratives need to be checked and validated involving the wider number of stakeholders in order to validate the contents representation.

8.1.3 Testing CoPe_it! with the TG community

TG case study has been also designed to test the integration between CoPe_it! and Compendium (see section 6.6). A group of four participants have been asked to discuss new challenges and open issues for the TG community to address in the next future. CoPe_it! has been used form the community members to conduct at distance discussions about results and challenges for the new biological production. Compendium maps that were used to represent organizational members and topic of past meetings have been imported in a CoPe_it! workspace to trigger the on line discussion. As we can see in the next image (Figure 8-8) nodes, pictures and images that were present in the process memory representation in Compendium (i.e. the representation of the organizations that was shown in Figure 8-2: TG Process Memory Views) have been imported in CoPe_it! workspace and discussed from the community members at distance through CoPe_it! As Moderators of the on-line community we have also assisted farmers to directly engage in the use of the tool. After that an evaluation questionnaire has been distributed to the participants in order to test CoPe_it! perceived usefulness and ease of use (Appendix 2 to view the questionnaire). Moreover general question on the tool has been made like: what would you use this tool for in your organization? What did you like dislike? How would you improve it? Reactions have been good but not so enthusiastic. In fact the agricultural community of Torre Guaceto is probably not ready to use ICT tools. As also admitted from one of the participants *they prefer personal interaction and communication out of any structured protocol*. TG is a small community of agricultures people use to work and discuss face-to-face, they are almost all of the same area thereby they do not need at-distance communication. Thereby they would use the tool especially for sharing and exchanging data and information more then for discussing or taking decisions. As suggested from them probably some try with new technology can be done involving especially the younger agricultures, may be involving also the child of the farmers, this would probably help, but in any case this cannot be the only way to interact in the community. In fact as suggested from the farmer, in the agricultural field a handshake and a look are always the best way to communicate. Thereby they see the tool as an experiences repository, a place where they can collect and interchange documents of common interest, a place where they can share best practices and experiences. Thereby they envisage more an asynchronous use of the tool and involving just the key actors like representative

of the group or interest and of the local agencies more them the all community of farmer. However they looks like they appreciate the possibility, if the tool would be used, to take trace of the path of events and collaboration within a group. They consider that it would help to understand the different positions of the stakeholders and also the changing positions and the evolution of relationship inside the community. It could be a good tool to understand the results of the interaction process within the group and also between the group of farmer and the enlarged community.

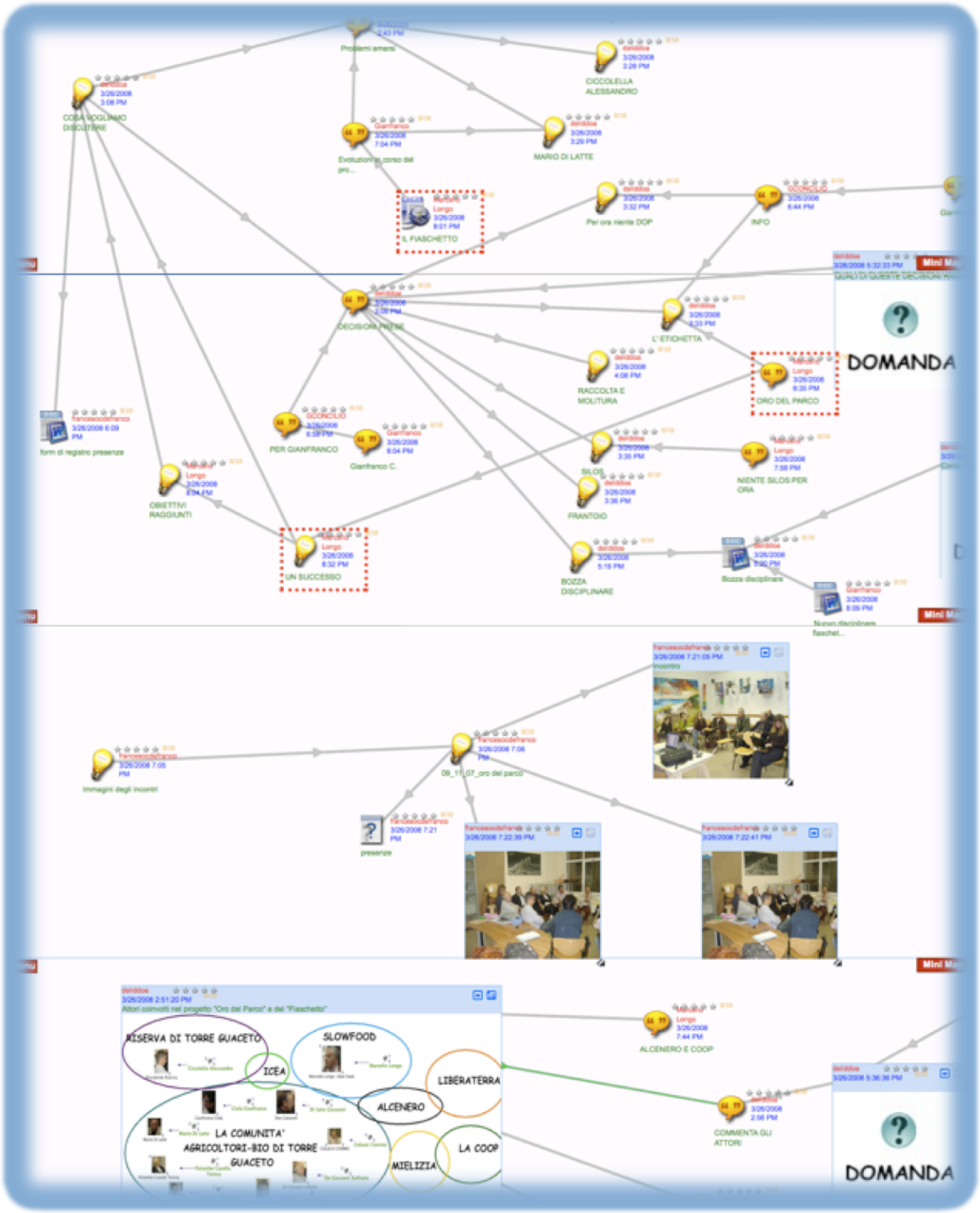

Figure 8-8: CoPe_it! Workspace for On-line Discussion in TG Community

8.2 CS – Campi Salentina: Drawing the Master Plan of a Town in the South of Italy

As discussed in the previous section the TG case study was not suitable to test how the process memory performs when the planning process and the stakeholder's deliberation concerns spatial problems. Thereby we did not test process memory building activities that the planner should perform to capture and represent spatial argumentation. The case study of Campi Salentina has been drawn exactly with this objective.

CS case study focus in the representation of deliberation process which typically occurs in small planning teams in order to take technical decisions on land use matters. Problems as definition of perimeters of geographical surfaces are normal issues within the planning team. The map of the planning area is an artefact continuously changing and evolving together with the design decisions of the group. The map is the background of planning discussion and the modelling clay in which the design process leave its marks. The final map is just the final evolutionary step, but it doesn't explain the reasons that bring to that final configuration. Because our aim is to trace the process of deliberation and to explain the reasons of design decisions we need:

- to refer claims and positions to the version of the map that the planning team was discussing when the claim have been raised.
- to trace the key evolutionary step which determined a change in the plan (both in the shape of the map or in the land regulations).

Like in the previous case study the process memory have been reconstruct post-hoc on the base of audio and video transcription. The information processing procedure consists like in the previous case in isolating the statements in concepts. Each concept is a node in a graph like structure and it is annotate with specific tags and associated to a specific IBIS icon.

In this case we focused in the representation of spatial argumentation and deign rationale in technical planning meetings.

In these meetings one of the objective is "coming out with the final drawing"; thereby the drawing itself, that is the base of the spatial argumentation, changes along with the deliberation process. In the other case studies we will face other types of planning meetings such as consultation meetings (SPP, MK, SPB) in which stakeholders were not entitled to produce any real change in the design artefact. Thereby this is a peculiar aspect of design meeting of the planning team and it requires a specific application of the spatial argumentation.

Figure 8-9 shows the results of the deliberation capturing and representation for such a king of meetings. The view develops in horizontal as along a time band. Indeed different versions of the map, which describe the temporal version of drawing of CS master plan, follow each other like in a narrative. In the up part of the figure we reported the information and knowledge sources used and related to the specific design step. In the down part of the image we find the map explaining the design rationale, that is to say explaining the reasons for the design modification at the given step. The argumentative contents included in this map should be

enough to explain the modification between the previous and the actual design step.

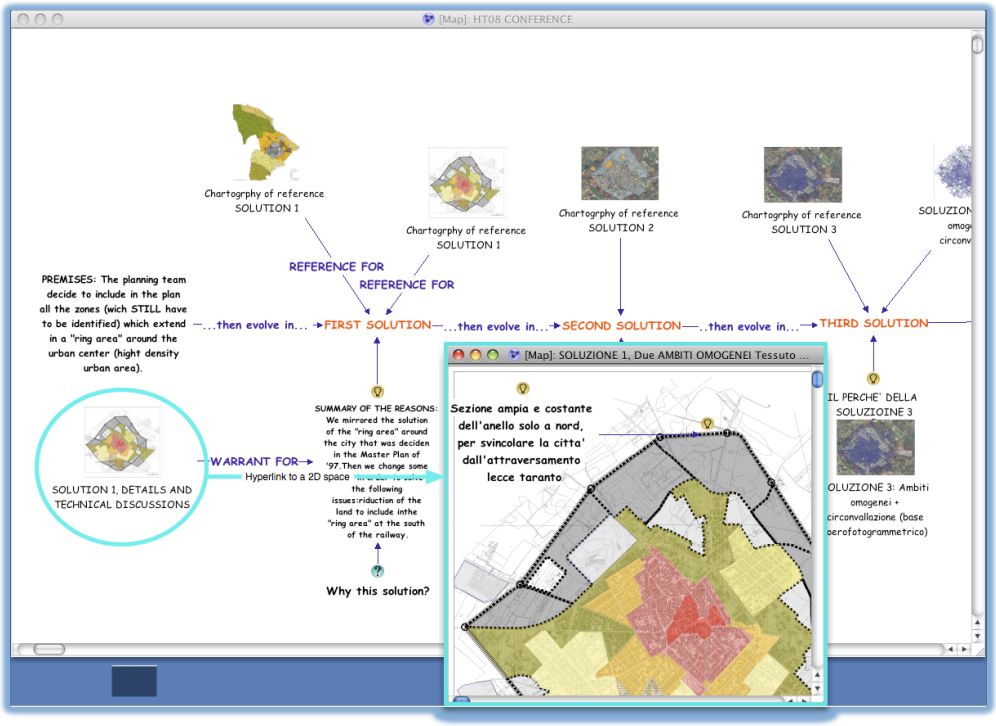

Figure 8-9: The Spatial Argumentation View for CS Case Study

This case study is oriented to support a different phase and different tasks within the urban planning process. We use this case to give an example of the geographical view. This case represent a very classical planning case, in particular one of the task to accomplish is the "definition of boundaries of the CS planning area". This is normally a very challenging task because planners have to define very precisely the areas to include in and exclude from the project. These decisions normally imply big changes in land use regulation, which strongly effect short and long term future of the community in the area. Without entering in too detailed descriptions. Figure 8-9 shows the geographical argumentation explaining the evolution of the plan drawing that is an example of how the memory platform can support the explanation and representation of process rationale.

As we can see an IBIS model has again been used to represent the evolution of the technical solution (from the first solution to the definitive one). Each solution it coupled with three nodes:

1) The 'warrant', which establishes the logical connections between premises and technical choices; this node contains the reasoning process to explain the solution. The warrant is then linked to a 'backing' node.

2) Backings present materials like meeting results or even meetings replays of precise moments in which certain choices have been taken. These are information that supports the warrant in explaining the reasoning behind solutions choices, solutions are explained trough arguments and claims that are represented and

related to the geographical area of interest, this being the features expressed from the geographical view.

3) References, which are maps images and technical reports used as references for each working-solution. These give technical context for claims and arguments.

In this case study knowledge object represented and managed during the process are: maps, reports, graphs etc; these objects are used in the technical discussion in order to make sense of the design rationale. If we look at the knowledge objects type used and represented in this case study we notice that geographical views have been key in order to support technical tasks and knowledge works representation and to explain the process rationale. On the contrary, exactly opposite to the TG case, the social dimension was less relevant in this case because participants were involved in technical decisions; also they were a few people and mostly member of the same group or of similar teams (experts). This is another example of how different planning tasks and different planning teams affect what is the key dimension for the planning process representation.

8.2.1 Discussion

This application gives an example of how the memory platform can be used to represent the rational behind technical decision taken during meetings of the planning team. There is always a phase of the planning process in which designer have to bring together all the information, knowledge and understanding gathered during the process and come out with possible design solutions. These meetings needs for different way to reconstruct and represent the planning process and the deliberation process behind it.

We gave an example of how the process memory platform can support the representation of spatial argumentation and design rational in such a kind of meetings. The CS application has been then presented to two of the CS designers to verify the effectiveness and quality of the representation. As a main result of the interviews with the two designers we gained some interesting hints. The two interviewees consider that the representation of the rationale of two following design steps is very clear. Anchoring the spatial arguments to the geographical area of interest is considered a very good and clear method to explain why certain modifications have been done. Nonetheless both the interviewee noticed that many information were actually missing, many of the key decisional points they remembered, were not represented in the process memory. There are two main explanation for this: first, the process memory have been reconstructed tracing just three of the 12 meetings of the project team, thereby many information were actually missing because they could not be trace back in any way. The second reason is that the knowledge manager entitled to build the process memory were not part of the planning team thereby had no feeling and knowledge about what was relevant to be traced, what were the key switching events which heavily effect the design process. As we will discuss also in the following tracing the design rationale is a practice which needs to be performed on going, and directly engaging the planning team. This case study give an example of how the memory platform can be used to effectively represent argumentative discussions and design rationale, but the effectiveness and the completeness of the representation is strictly bound to intentional commitment of the planning team to spend time and effort to do it.

8.3 MK - The Case of Milton Keynes Master Plan

The case study of Milton Keynes master plan is a quasi-naturalistic case study which has been driven to test deliberation capturing trough video annotation of face-to-face meetings. FM has been used to capture and annotate the video of a small team meeting. The video annotation have been performed life during the meeting and following the second annotation procedure described in section 6.4.

The experimentation has been defined quasi naturalistic because it wanted to simulate a small group meeting to evaluate Milton Keynes master plan and discuss the problem of the new town. The meeting objective is to screen the Milton Keynes master plan objective one by one and discuss with the group if they had been achieved or not; and if not what have been the obstacles or errors of the previsions of the plan. It is quasi-naturalistic because the participants to the meetings were all Milton Keynes citizens of heterogeneous ages, backgrounds and nationalities. Within the participants there was also a team of the old Milton Keynes development corporation, which worked for real in the seventy to the plan development. Thereby the discussions were authentic and this made the conversation particularly lively and interesting. However our intention here it is not to discuss the finding of the meeting but to test the performance of the life capturing and annotation of the meeting video with FM.

As we can see in the next figure the application of this deliberation capturing technique requires two people.

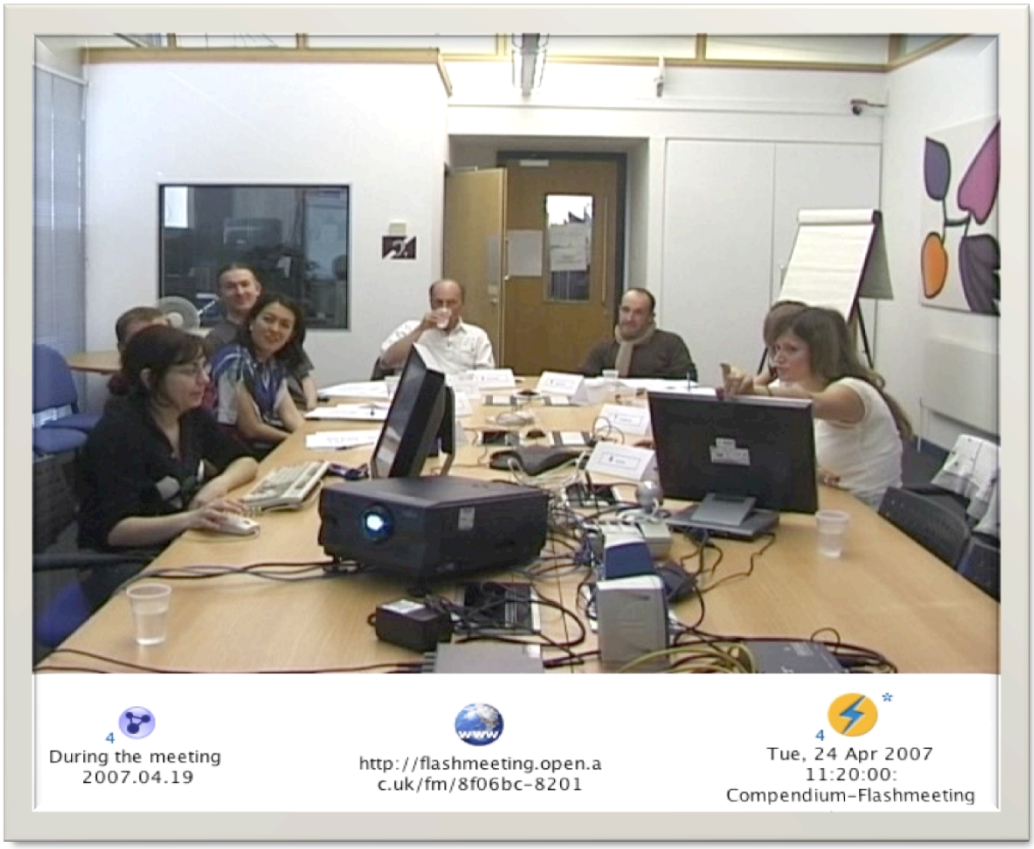

Figure 8-10: Life Capturing and Annotation of the Meeting Video with FM

One person is in charge of the meeting moderation (see the extreme right person in the figure), the other one performs the video annotation with FM. Compendium have been used by the moderator to introduce the issues to discuss and also to take note of the claims raised by the participants during the meeting.

At the end of the meeting we have as results the notes taken during the meeting by the moderator in Compendium and the FM video file annotated per intervention and per author. As we can see in Figure 8-11, on the left part we see the notes taken during the meeting. As we can notice in the figure the claims are represented with undifferentiated icons, not labelled links, and with no reference to the author of the claim. Thereby it is difficult to understand the discussion flow and make sense of the deliberation process.

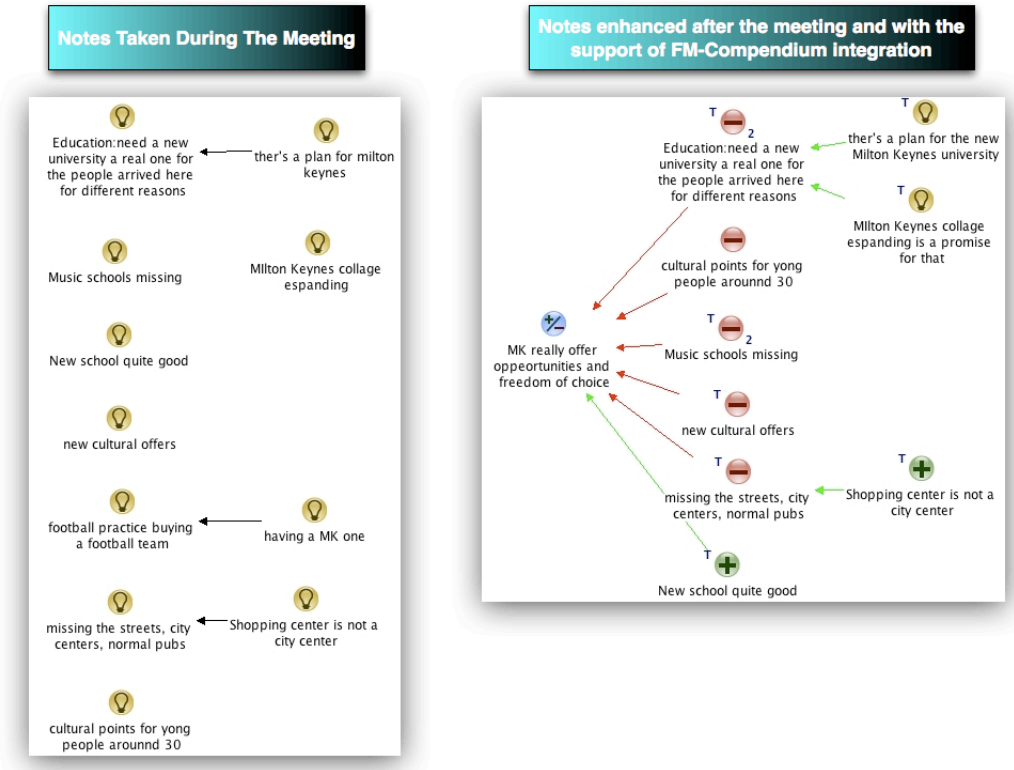

Figure 8-11: Difference Between Note Taking During the Meeting and Post-hoc Enhanced Issue Maps

The same figure on the right shows how the representation can be enhanced after the meeting by importing in Compendium FM contents. FM exports the indexes to the video replay created during the meeting in form of reference nodes in Compendium environment. After that the knowledge manager needs to perform the following activities:

- to tag the index to the claim with the name of the author of the claim
- to automatically create a list of claims for each author to be associated to the personal view in the process memory
- to go back to the meeting notes and enhance them by replaying the meeting and associating to each claim the right index to the video replay.

Figure 8-12 shows the results of this memory building procedure. Each participant is associated to general info and to the list of his statements (left windows in Figure 8-12). Moreover the key statements raised by him are also associated to the reference node (central window in Figure 8-12) which link the node to the video replay of the claim within FM (right window in the figure). In this way the users of the memory platform can either explore the contents by authors, or by discussion, or by video in FM. All the claims are hyperlinked thereby the navigation can happen traversing Compendium and FM environments.

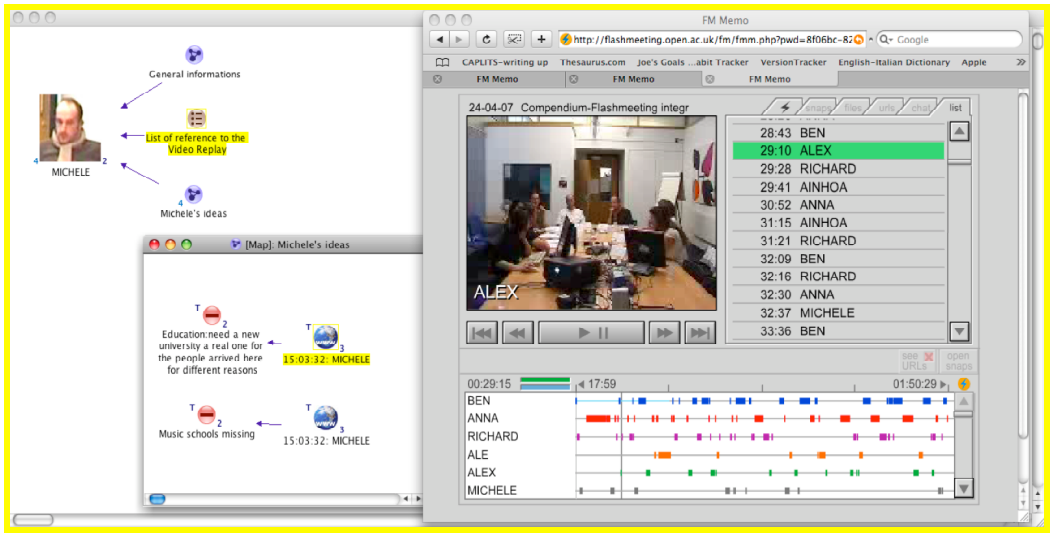

Figure 8-12: Integration Compendium-FM

A final observation concerns the reorganization and representation of the key issues following an IBIS argumentation model (right image in Figure 8-11). These maps are issue maps and they are different from the dialogue maps created in the TG case study. They represent the key issues as collaboratively discussed and recognised by the stakeholders during the meetings, but they are not complete representation of the all deliberation process. There are pro and con of this. Issue maps of the key arguments and position are more slim representation of the meeting results, they are a sort of meeting summary, whereas in this case the deliberation details can be traced back by replaying the video. The integration of FM and Compendium allow exploring just the key moments. Thereby the users can replay the video just focusing on what they opine to be relevant and interesting, without being oblige to replay the entire video meeting. Moreover the fact that the notes of the key point have been taken life during the meetings and involving the participants enhance the credibility and authenticity of the identification of what are the key points of discussion. In fact the notes taken by the moderator in compendium were projected to the wall so that the entire group could discuss and question the contents. Thereby the identification of the key issue was not entrusted to the knowledge manager and his post-hoc interpretation. On the contrary it is discussed and validated by the group. The knowledge manager work that is done out of the meeting room help to enhance the representation by organising the contents and relating the claims to the video replay.

8.3.1 Discussion

This case study gives an example of how the integration of Compendium and FM can enhance the representation of deliberation contents with links to the video replay of the meetings. Moreover the described procedure of deliberation capturing and representation is obtained with a mix of work done in and out the meeting room. This mixed procedure reduces the interpretation effort that the knowledge manager have to do post-hoc, thereby the map of the key issue can be trusted as directly generate by the group during the meeting. Moreover the transparency of the deliberation process is insured by the links to the video-replay.

This procedure is then the less time and work consuming for the planning team in term of work to do out of the meeting room and at the same time the most transparent and reliable representation of the deliberation contents because it base on the video replay. Videos are the raw data that are made available and easily to explore by the users so that they can also question the representation of the deliberation process provided by the process memory platform. This case study shows that the process memory platform provides the users with the mean to evaluate and question its contents and performances.

8.4 PAU - Parco Agrario degli Ulivi

This case study has been driven to build a scenario use of CoPe_it! in a real Planning case. The "Parco Agrario degli Ulivi" (PAU) Community of Practice borne in 2001 when a research group (professors and researchers) from the Polytechnic of Bari (DAU: Dipartimento di Architettura e Urbanistica) decided to discuss the environmental issues about a illegal practice of setting out of the ground 'olive oil' trees in order to commercialize them. These are secular trees which are environmental patrimony of the region so the research group started a campaign to make students aware of the implication of this bad practice. The first action of the group was to start a consultation with local actors in order to: i. inform local community and agency about the side effect of such a practice; ii. Identify possible project proposal and new partners. This event determined the emerging of the PAU community. A heterogeneous group of, researchers, students, professors, citizens, NGOs, cultural and social associations and schools join the campaign. The community objective becomes to stop this bad practice and defend the Olive oil area as a Natural Park Area. Ten thousand people signed a petition to found a PAU protected area. Then the community started to enlarge and many associations started to support the initiative advertising about the PAU community on their web sites. The community performed other actions like: a congress to present the community initiatives (July 2002, participants: 500), meetings, informative days etc. In 2003 an official PAU association is founded. Participants who signed the act are: local administrators, farmers, businessmen, university researchers, tourist operators, environmentalists and citizens. Some first documents of action priorities are signed and many other initiatives are organized to disseminate information. Nowadays the community is borne and it auto-organized itself giving a clear structure and objectives.

The role played by the DAU group is a key role. It is the starting actor and he is still playing a coordination role in order to promote and organize new activities and

detecting and encouraging the self-emerging activities within the community. The objective now is to push the community in a more operative phase of action on the territory. So new operational objectives and planning actions need to be defined and new initiatives to be explored. So the DAU group wants to discuss new operational objectives and priorities within the group and then enlarge the discussion to the entire community. Thereby experimentation has been driven by two researcher and one PhD student of the DAU group in which they were involved in an on line discussion assisted by CoPe_it! to discuss objectives and priorities. The interaction happened in one day in asynchronous way.

Shows the results of the discussion. If we observe and analyze the discussion contents we can see that Adele, a researcher of the DAU group, triggered the discussion posing two main background questions about: i. strategic actions to enhance environmental conservation; ii: how to follow the lines of development suggested from the community until that moment. Francesco, another DAU researcher, pointed out that the community in past meetings wanted to focus on the environmental valorization more then on the protection. He outlined that unluckily the regional low is focused only on environmental parameters to preserve then on the economic and social valorization of environmental resources. Grazia agreed with him and then the three members started to discuss the valorization problem.

The desktops view shows that this topic came back in the discussion several times as a key point. Two other main ideas were suggested from the three members in order to sort out strategic actions to implement: i. to push institutions in order to define official a PAU Natural Protected Area; ii. to suggest and discuss changes of the regional low. Slowly during the discussion the three members understood there were doubts about the main objective the Community should have; thereby at the end of the discussion the members defined a new operational objective: the organization of a meeting putting together all the social actors and institutions (one for each province interested). The objective of the meeting should be to define a new common objective for the community between three options: i. creating a new Natural Park; ii. Changing the regional low, iii. Focusing on the valorization of environmental resources. The main outcome of the discussion is the decision to enlarge the discussion to the whole community.

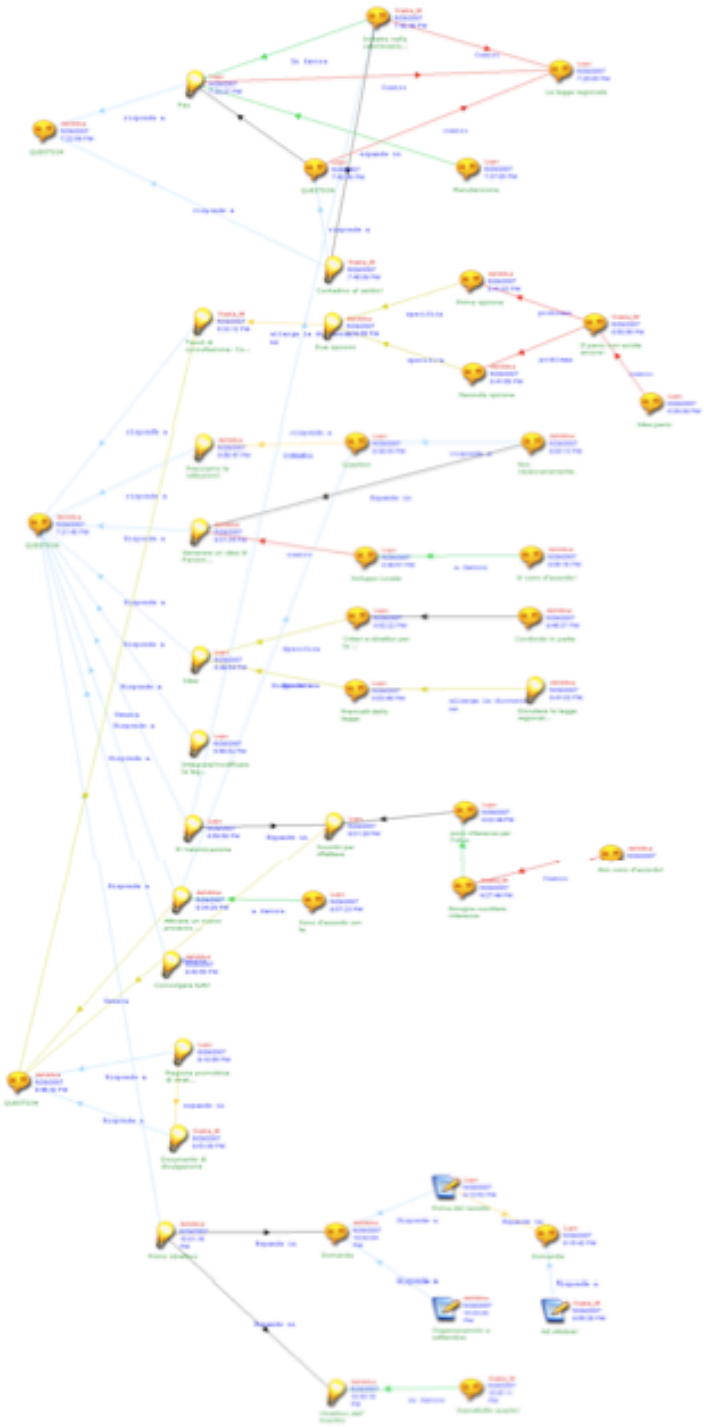

Figure 8-13: On-Line Discussion Performed in CoPe_it! Workspace from the PAU Group

8.4.1 Discussion and Evaluation

PAU case study shows that the use of CoPe_it! helped community members to reorganize their ideas after the discussion. The general overview offered from the Desktop View of CoPe_it! helped them to reorganize main ideas, arguments and

counterarguments and then it helped them in establishing priorities. So the discussion started with the objective to define strategic actions, but during the discussion the three members discovered that they did not agree on the main objective for the PAU. So they decided that one priority should have been the organization of a meeting in which they enlarge the discussion to the whole community members. Especially in this scenario CoPe_it! can be a valuable support, because of the large number and heterogeneity of community members and the difficulties to have all of them present in the same meeting. This is why an asynchrony web-based discussion can be suitable in order to ensure a wider participation to the topic of discussion (member can enter and add comments and idea asynchronously whenever they are available).

After the experimentation a CoPe_it! evaluation questionnaire have been distributed to evaluate perceived usefulness and ease of use of the tool. Like in the case of TG you can refer to Appendix 2 to view the questionnaire.

Results of the questionnaires suggest that the tool have been easy to use but not of immediate learning. The users consider to use useful to trace the agreement in a group and also they envisage enhancing the tool adding a view which is able to select the single actor and it allows exploring the contributions actor by actor. This remark seems to be very interesting because this feature is guarantee by the social view in the memory platform. Moreover they suggest having a temporal representation also of the sequence of the raised statements. In this concern CoPe_it! future development plan will provide CoPe_it! workspaces also of a forum view which follow the classical time threat. What is interesting is that CoPe_it allow just one of the interaction and exploration mode of the memory platform that is the argumentative view. In this simple case the users suggest that the temporal and the social view have a key importance to support the understanding of discussion contents. These are further evidence in favour of our heuristic knowledge object taxonomy proposed in chapter 3.

8.5 SPB - Strategic Plan of Bari

Like in the case of MK, this case study has been driven to test deliberation capturing trough video annotation of face-to-face meetings. Also the use of Compendium for life note keeping during the meeting has been tested in order to maximise the work to do during the meeting and minimise the time effort to invest post-hoc.

Unlike the case of MK in this case study the moderator did not use compendium in the meeting moderation and he did not involve the participants in the note keeping process and in the identification of the key issues. In this case the meeting is part of a consultation process of the community of the metropolitan area of Bari, a city of 35.000 inhabitants in the south of Italy. The strategic plan involves 31 municipalities thereby the strategic plan and the consultation process have been challenging for the planning team. Because of the scale of the plan and the extensive number of community involved the consultation process has been conducted involving lay representative and local expert of 13 selected themes. The planning scientific committee defined these themes as the relevant themes to address in order to face the future of the metropolitan area in the next 20 years.

The SPB and in particular the consultation phase have been organised in 19th thematic meetings on the topics of: Agricultural-industrial development, Cooperation, Culture and Industry, Energy, Job and Training, Young people and the future, Internationalisation, Coastal areas, Research and innovation, Industrial development, Transport and infrastructure, Tourism, Welfare, Commerce and delivery, Sport and free time, Architecture and Urban Planning, Houses and peripheries.

The consultation meetings were not organised as discussion and comparison between participants, they were more listening meeting to gather new ideas from the local community. Each person could intervene for no more then three minutes and then leave the word to someone else. This meeting format affected the representation results. Indeed the process memory information architecture is based on tracing dialogue and interaction with an IBIS model, in this case the interaction between participants was almost null and the meeting representation was reduced to the sequence of participants intervention. Nonetheless we decided to test the integration of FM and Compendium and to test the life video annotation of the consultation meetings. We took part to three of the 19th meetings. Two of them have been video recorded and annotate life with FM during the meeting. The annotation procedure have been different from the one used in MK case study. In fact in this SPB case the meetings had many participants (about 60 per meeting) and participants number and identity was not known in advance, thereby the second annotation procedure was not suitable. Thereby we indexed the video with words, concepts or phases instead of annotating the video with authors.

Results of the application are shown in Figure 8-14. As we can see in the picture FM provide at the end of the meeting a sort of hypermedia summary. All the annotation can be imported as list of reference nodes in Compendium (Figure 8-14). By clicking on each of the row of the list users can access directly the video replay (Figure 8-14) in FM where the annotation has been created. Also Compendium can create a direct access to the meeting summary (Figure 8-14) in FM, which consist of the meeting video plus the meeting minutes, which is a temporal list of the annotations as they occurred during the meeting. These are the key concepts and claims that have been annotated and are listed by time sequence and hyper-linked to the video replay. This hypermedia summary is easier to explore and transparent, because it links the claims to the information source, that is the video. This case study prove as the process memory platform could have enriched the results of the participatory process by disclosing and delivering on the PSB web site the results of the consultation meetings in a more accessible way and without any additional effort from the planning team.

SPB case study shows how the process memory platform can help to enhance, by making it faster and easier, the capturing and representation of results of consultation meetings.

8.5.1 Discussion

Comparing what has been published on line on the SPB web site and what could have been provided by using the process memory platform we can deduce that simply connecting claims to video resources can make a big difference in term of what is actually really accessible and easy to explore. Transparency does not just

mean providing the raw data, but also supporting the accessibility of this information so that this can really used and questioned by the enlarged community. In this sense the memory platform support transparency by connecting claims raised to meeting events that can be easily replayed and analysed by the users.

Figure 8-14: SPB Case Study: Results of the Integration of FM and Compendium

9 Testing Memory Building Activities: SPP - San Pietro Piturno Case Study - An Experience of Neighbourhood Regeneration

In this chapter we focus on memory building activities to be performed in order to build the process memory of public consultation meetings. In particular we describe how the Compendium hypermedia tool, previously described in chapter 6, is used to implement an information architecture and annotation scheme specifically designed for tracing deliberation in planning conversations.

The framework for: (1) information processing, (2) structuring and (3) representation discourse will be described in this chapter and contextualized to the SPP case. Compendium will be applied, following this framework, to represent the collaborative memory of the participatory planning process conducted in San Pietro Piturno. Finally, the results of this application will be discussed, in the light of the evaluation results of three semi-structured interviews conducted with some of the key actors in the SPP project.

9.1 SPP Project: A Short Introduction

The SPP project is an example of community engagement in a very local based initiative designed to address the problem of social exclusion in a small neighbourhood in the south of Italy, called San Pietro Piturno (SPP). The initiative intended to provide a strategic vision for the area and in particular to identify local resources in terms of agencies and human capital. The objective of the project was to enhance partnership actions and to develop collaborative initiatives involving agencies from the statutory, voluntary, community and private sectors.

The case study has been built around a participatory planning experience carried out in April 2006. SPP is a small neighbourhood of 1300 people in Putignano Municipality (that is one small municipality of Puglia Region, Southern Italy). SPP is a neighbourhood with a difficult social context and with serious problems of social integration and exclusion.

The participatory planning process started from the Municipality will to involve SPP inhabitants in the design of a project of renewal and rehabilitation for SPP. The project was then supposed to be consigned to the National Government in order to be evaluated and, eventually, founded.

The participatory process was carried out by ISF (Ingegneri Senza Frontiere, or Engineers Without Frontiers). ISF is an association of social promotion for

enhancing cooperation and development. ISF organized the participatory phase in two face-to-face meetings with the local community.

The first meeting was a brainstorming meeting in which a group of citizens (about 50 people) was asked to think about the main problems and needs of the neighbourhood. In the second meeting they were asked to think about resources and opportunities of their neighbourhood. The meeting mediator was an architect (from the department of Urban Planning of Polytechnic of Bari), and she was part of the team assigned from the municipality to draw up the project.

In the case study the ISF team used conventional tools to support multiple perspectives on problems and to assist the debate, using sticky notes on a wall panel to capture participants' views, which were then analysed and written up in a final report.

After this participatory experience in SPP, SPP municipality appointed the same planning team to draw up the PIRP that is the general Integrated Programme of Regeneration of urban suburbs (Periphery) for the area of SPP. This is an Urban Plan that is supposed to affect the future of the area in a longer-term period.

The ISF team was again in charge of the participatory phase, and so faced the need to reuse and structure the materials and contents of their previous SPP meetings (which were by now six months old).

9.2 The Problem of 'Lost Memories'

The ISF team was now dependent on the final report, on the videos of the meetings, and on the personal memories that ISF participants had about the process. Moreover, some of the original team members had left the organization taking with them their perspectives.

As is always the case, the final report consisted of a mix of 'knowledge from the community' and 'knowledge from ISF about the community and the participatory process itself'; and it was quite difficult to distinguish between the two knowledge sources.

The ISF president, who was the meetings' moderator in the SPP project, reported during an ad-hoc interview we conducted with her, that ISF members got to understand SPP community to a deep extent. They "experienced conflicts, listened to people's stories, listened to people's complaints and needs". They "discussed with the children about the way they see their neighbourhood and then discovered how they would like to transform it".

All these experiences constituted the ISF personal and collective knowledge of ISF group about SPP which informed their report. What was missing was any account of how this complex and rich knowledge 'magma' had been converted into the report? Who or what was the source of given contribution? Whose voices were heard, and whose were lost? Too often the knowledge gathered during participatory processes remains hidden in the memory of the people involved in the process. A large body of knowledge remains unexpressed, for instance, 'social' knowledge about the people who created conflicts, those who offered original ideas, whose who solved problems or who gave unexpected resources.

Collaborative processes are social processes that generate rich knowledge about the 'places' — in our case knowledge about the SPP neighbourhood, with its community, people and problems. This knowledge remains implicit and unshared in the memories of the participants. The only outcome that last is a textual report enriched with a few pictures that is just a small part and synthesis of all the knowledge gathered during the process. Thereby the question is: there are better ways to track, store and represent the group memory? The main aim for a group memory support system for participatory planning is to trace knowledge about the social process so that this is not fragmented and lost in the memories of participants but it becomes a collaborative-process memory that can be re-explored, used and interpreted afterward. As also discussed in section 3.2, 5.1 and 5.2for social process we mean the process of interaction and collaboration which happens at organizational levels between stakeholders from the social society when they participate to the planning process. Social process is the participatory planning process per se, and social knowledge is the knowledge created throughout the participatory planning process with a specific focus on the meanings and impact of this process at level of social phenomenon. A collaborative-process memory system is an environment to track, store and share knowledge and understandings about the planning process as social process making it explicit and reusable, making this memory a 'living' entity always changing and evolving in new interpretation of facts, events and information (Boland and Tenkasi '95; Bannon and Kutti '02). Collaborative projects are group activities of expressing personal knowledge and sharing it with the group. In order for the memory of this process to be valued, technical activities of information and knowledge modelling (processing and structuring) and representation can be performed. So that the process memory can be build and then collective activities of exploring this memory and interpreting and re-interpreting knowledge and information can be performed.

9.3 Modelling Process Memory as Hypermedia Discourse

In the present case we could not trace the whole process memory because the project was already concluded, thereby we focused on consultation meetings with the local community, of which we had available the video records.

We used Compendium to reconstruct post-hoc the group memory, that is to say the memory of the consultation meetings and the deliberation process developed with SPP community within these meetings.

Compendium was used to structure and represent knowledge about the participatory process in its wide and diverse dimensions. This knowledge about the process is meant to be the collaborative-process memory and the process memory system is designed to allow users (both ISF groups and SPP community) to navigate into the contents and interpret the history of those meetings.

What we did was using Compendium to map the flow of the meetings' discussions. We transcribed the videos and then analyzed meeting discussions with an information modelling approach. Our modelling process consists of three phases: information processing (information parsing and indexing), information structuring (organization of contents according to a specific information architecture) and

information representation (stressing the visual features of Compendium to represent multimedia contents). In the next sections we describe one by one the three phases.

9.4 Information Processing

The discourse-modelling phase concerns the activities of information parsing and indexing. We should be aware that our information base is 'a planning conversation'. Therefore the information chunks produced from parsing the transcript are contributions from the stakeholders during a conversation. A contribution is defined as a meaningful part of discourse that can be attributed to one author. The opening of a contribution is defined when the person starts to talk, with closure occurring in three ways: i. when the person finishes speaking, ii. when another person intervenes, iii. when an unexpected event occurs.

Furthermore a contribution is transcribed and considered an information chunk when it is a meaningful expression of an idea. This means that not every single word is transcribed but just 'relevant concepts' to the meeting objective and/or relevant to reconstruct the discussion flow.

As we can see from the annotation schema (Figure 9-1) a contribution is annotated according to three semantic dimensions expressing: function of the contribution within the discussion (task within the discussion); role played by the contribution against the overall project/meeting objective (task within the project); author of the contribution (source).

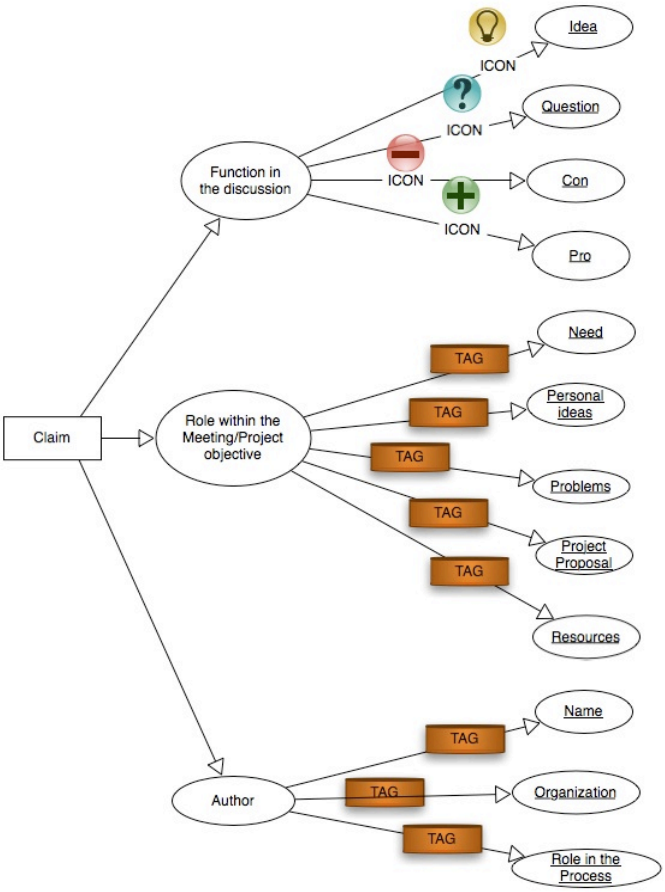

Figure 9-1: Annotation Schema

To express the three semantic dimensions we used two annotation methods: tagging and icon association. We now describe the annotation procedure and methods for each of the semantic dimensions to contributions.

It should be emphasised there is no pretence that through the combination of video with discourse modelling we are "neutrally capturing" the "entire meeting": clearly, there is no such thing. However, as we hope the following examples illustrate, we are constructing a set of interpretive resources to assist the reconstruction of what happened. Video captures some of the richness of a meeting (through the limited lens of the camera), while the discourse modelling in Compendium indexes this by participant contributions, within and across the different dimensions (through the interpretive lens of the modeller, using the modelling/coding scheme in a systematic manner).

9.4.1 The First Semantic Dimension: Role of the Contribution within the Discussion

For the first semantic dimension, which expresses the function of the contribution within the discussion, we followed an IBIS (Issue, Based Information System) argumentation model (see (Kuntz and Rittel '72; Conklin and Begeman '88; Conklin, Selvin et al. '01) for a detailed description of IBIS model). The IBIS model has been used to represent and structure discussions underlying argumentation flow and agreements/disagreements points. The main aim of using an IBIS model is to represent discussion contents so that these contents can be easily explored after the

meeting, and interpreted by the users. The objective (tested later) is that users can freely make sense of the argumentation flow, of the main ideas, points and questions raised during the meeting, understanding their role within the discussion, and their effects in the deliberation process (e.g. did the contribution lead to conflict, or agreement, and why?). IBIS method have been largely used by Rittel in the design and planning domain, in order to support the design process of complex problems in which 'argumentation' and design conversations are the burn that constitutes the design process. We used IBIS to structure and represent the threat to rebuild the design history.

Starting from the general IBIS syntax, in our application we use a revised classification scheme to organize the data. The classification scheme consists of five main node types (issues, positions, arguments, pro, con and decision) and several link types (responds-to, questions, supports, objects-to, specializes, generalizes, about, is suggested by, etc). Nodes and links are defined to follow the classification scheme specified in Figure 9-3. This classification scheme is a revised form from gIBIS scheme (Figure 9-2)

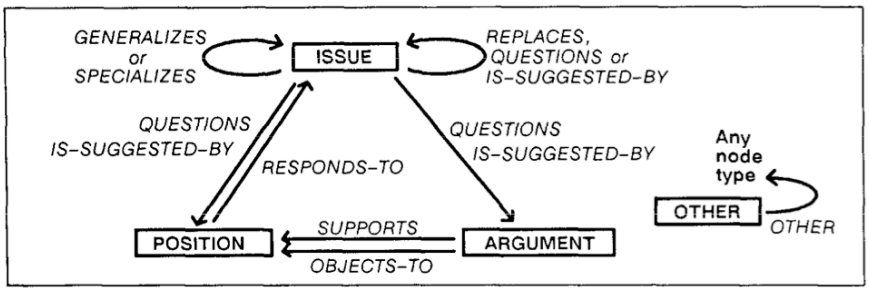

Figure 9-2: "The Set of Legal Rhetorical Moves in IBIS" (Conklin and Begeman '88)

Conklin subsequently extended this scheme in the QuestMap product from gIBIS prototype, which formed the basis for the current Compendium tool, which we adopt (Figure 9-3):

- Neutral arguments are used when it is unclear and open to the user interpretation whether a contribution is in favour or against.
- Notes nodes that are used by the analyst to add a-side comments to the conversation.
- Decision nodes that are used to underline agreement within the group.

Decision icons were not included in the discourse modelling schema proposed in section 9.4. That's because decisions are not claims done by one uttering, they are events happening when an agreement occur between participants about a certain issue. Therefore decisions are events recorded by the knowledge manager while proceeding in the information and knowledge modelling or afterward during the information and knowledge exploration and extraction phase.

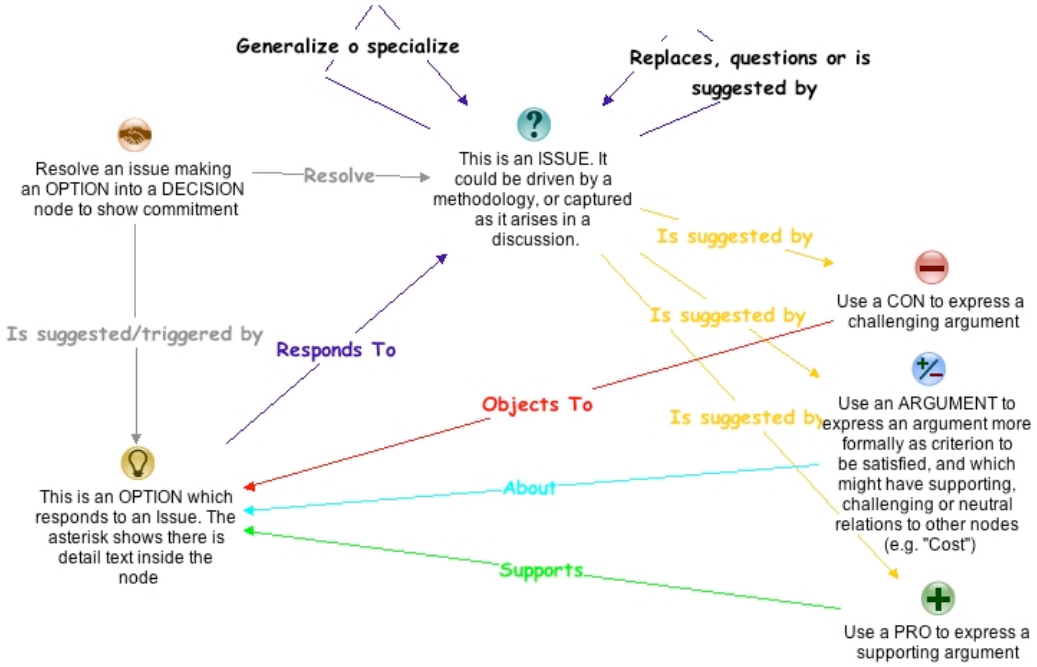

Figure 9-3: IBIS Model Modified from Conklin and Begeman (Conklin and Begeman '88)

The addition of decision nodes is particularly relevant because it aims at supporting decision-making oriented meetings, underlying when agreements or decisions occur in the discussion flow.

In our application the IBIS model is not the framework used to moderate the life discussion but it is:

- the framework the knowledge engineer used to interpret the discussion flow and
- the syntax he used to represent discussion outcomes.

The revised gIBIS model has been used in the first annotation process to express the role of each contribution in the discussion flow. We associated to each contribution the appropriate icon according to the classification schema. Furthermore the contributions are linked with the appropriate link type. The result is a graph like argumentation structure representing the discussion. The user can reconstruct the discussion flow by performing three cognitive actions: recognizing the meaning of the icons, following the links direction and/or reading the link label. These actions allow the users to reconstruct the discussion flow focusing on argumentation dynamics (Argument pro and con), and monitoring the discussion evolution from the issues to the agreements (decision nodes).

9.4.2 The Second Semantic Dimension: Role of Contribution Against Meeting Objectives

The second annotation procedure regards the role of the contribution in the meeting and the function it can play when analyzing meeting outcomes in relation to the specific meeting objective. This annotation aims to make explicit how the

information can contribute to the meeting objective. In our case the meetings had the objective to gather information about problems and resources of SPP neighbourhood. Thereby we grouped contributions in four classes: problems, needs, personal ideas and project proposal. Qualitative data analysis codes for each of these were assigned to contributions using Compendium's tagging mechanism (whereby one or more tags are assigned to the icon representing each contribution).

The need to distinguish between problems and needs is based on the following considerations: If a participant is aware of the problem and has some idea about how it can be solved we code it as a need (e.g. We need a bus stop close to the neighbourhood). If the need is clearly expressed and it is legitimate, it is then an issue of how and when the municipality is going to solve it. On the other hand if a need is clearly expressed but not legitimate, it is then an issue of how to argue and explain that this contribution is not legitimate. In both cases the expressed need exposes a policy issue to be resolved.

On the other hand if a participant has clear the problem but has no ideas of how it can be solved, the contribution will be stated in terms of problem (e.g. There is poor visibility at the junction with the main road). Therefore these contributions ask for technical skills and expert studies in order to be addressed.

During the results analysis, this distinction can help planners in making a distinction between technical and policy-making issues.

The other two tags distinguish between open ideas and project proposals. The tag "project proposal" refers to contributions that express specific ideas about the project, such as design priorities and alternatives that are spontaneously raised during the discussion or trigged by specific questions. On the contrary 'Open ideas' have a general meaning and do not refer to specific project issues. Contributions tagged as 'open ideas' can be suggested by specific discussion stances and are used to negotiate meanings or to share narratives or information with the group during the discussions. Suggestions and proposals that are not answers to specific questions posed by someone have been also tagged as 'Open ideas'. Those are spontaneous non-antagonistic proposals raised by participants. An open idea is like a new issue brought to discussion. Thereby if an 'open idea' doesn't trigger any counter-contribution from the group, we consider that this can imply three kinds of positions of the group around the contribution: i.consensus; ii.lack of interest; iii.scarce knowledge about the topic. At this point is up to the planner to discover what is the case, and to understand the way in which the group looks at such contributions.

If the modelling is carried out in as part of the real planning process, we hypothesise that it can help planners:

- to distinguish between problems that ask for planning actions and issues that ask for policy actions,
- to prevent conflicts by monitoring disagreements around specific issues,
- to expose issues that need to be explained or better addressed in order to be discussed and understood between participants.

Performing this as a post-hoc knowledge management and knowledge representation activity helps planners to reflect on the planning process as social

process of deliberation. In particular, retrospective viewing of community meeting videos, and annotating them in the manner described, consolidates individual and collective knowledge when returning to a project for further work, as in the SPP case study (see section 9.1). In addition we showed how this annotation process could help surface knowledge hidden in the meeting dynamics. This knowledge can be made explicit by analyzing the deliberation process.

9.4.3 The Third Semantic Dimension: the Author of the Contribution

The third annotation regards the source of the contribution. Each contribution is annotated with: i.the name of the participant who raised it, ii.his organization of affiliation and iii.the role played by the participant in the planning process (i.e. member of the community, expert-team member, representative of an institution or agency etc).

This third annotation focuses on the organizational impact of contributions. In order to understand why the organizational focus is important we think about what actually happens in the early stages of a planning process. When a planning process starts, objectives and design strategies are pointed out by the planning team and a first distribution of roles and tasks starts to emerge. Several organizations start being involved in the process. Each professional involved in the project has an affiliation. Furthermore any other institutional and non-institutional organization which has a stake in the process is usually involved to discuss strategic lines, rules, schedules, overall objectives and constraints as defined within the call for bid. The whole configuration of organizations involved directly and indirectly in the project starts to be defined and a new emerging organization takes form around the planning process. This organization includes members from different affiliations, which are then grouped in new project teams. In these teams each member has a new and specific role that is his role he plays in the emerging organization.

As a result, each stakeholder plays two roles, one in the organization of origin and another one in the new emerging organization. Distinguishing between these roles is important in order to understand the expertise that each member has and the organizational network he can reach. Indeed, this second aspect can play an important role when thinking about: i.what organizational resources the member can access and potentially use during the project; and ii. what snowball effects he can generate when delivering project results.

Given this understanding, the third annotation process helps tracing and exploring the organizational implications of contributions both within the discussions and in the broader context of the project.

9.5 Information Structuring: The Information Architecture

In the previous section we described how the information modelling activities have been performed: the videos of the consultation meetings have been transcribed, the transcript has then been decomposed in information chucks (the contributions) and each resulting node in the network has been coded ("tagged") according to the annotation schema and annotation methods described. These parsing and coding

schemes constitute the framework we developed for Compendium to capture relationships between the planning process and the knowledge resources used for making the planning design-decisions (*project proposals*, *expressed needs*, *personnel roles*, *organizational stakeholders,* etc.) We showed how it is possible to extract and gather this knowledge by modelling, annotating and interpreting the contributions raised during the consultation meeting (information chunks).

Now we have to organize this information in order to reconstruct and represent the group memory of consultation meetings, so that this memory can be explored and interpreted both from the community and from the planning team.

At the end of the discourse modelling phase all meetings are tagged and grouped in a series of interlinked argumentation maps which represent our knowledge base about the deliberation process. On top of this base we have built an information architecture to make the contents more easily explorable, and to make sense of different aspects of the deliberation process.

We organized the contents in five views, each of them representing a different contextual dimension in which the contents of the deliberation process can be represented and interpreted. Each dimension is a lens, a different "point of view" on the deliberation process. Changing the dimension we change the perspective with which we represent, visualize and look at the deliberation contexts. Different views can then trigger different insights and information on the same process.

Each dimension is also a key context of the deliberation process we want to analyze. The five dimensions are:

- Social dimension
- Conceptual/argumentative dimension
- Spatial dimension
- Temporal dimension
- Project oriented dimension

Each dimension is not a filter because there is not information that is excluded from the 'filtered view'. Each dimension is like a different 'user interface' to access the same knowledge base (the IBIS map representing design conversations). We structured the hypermedia database according to the following information architecture (Figure 9-4). In the following we analyze the information architecture view by view.

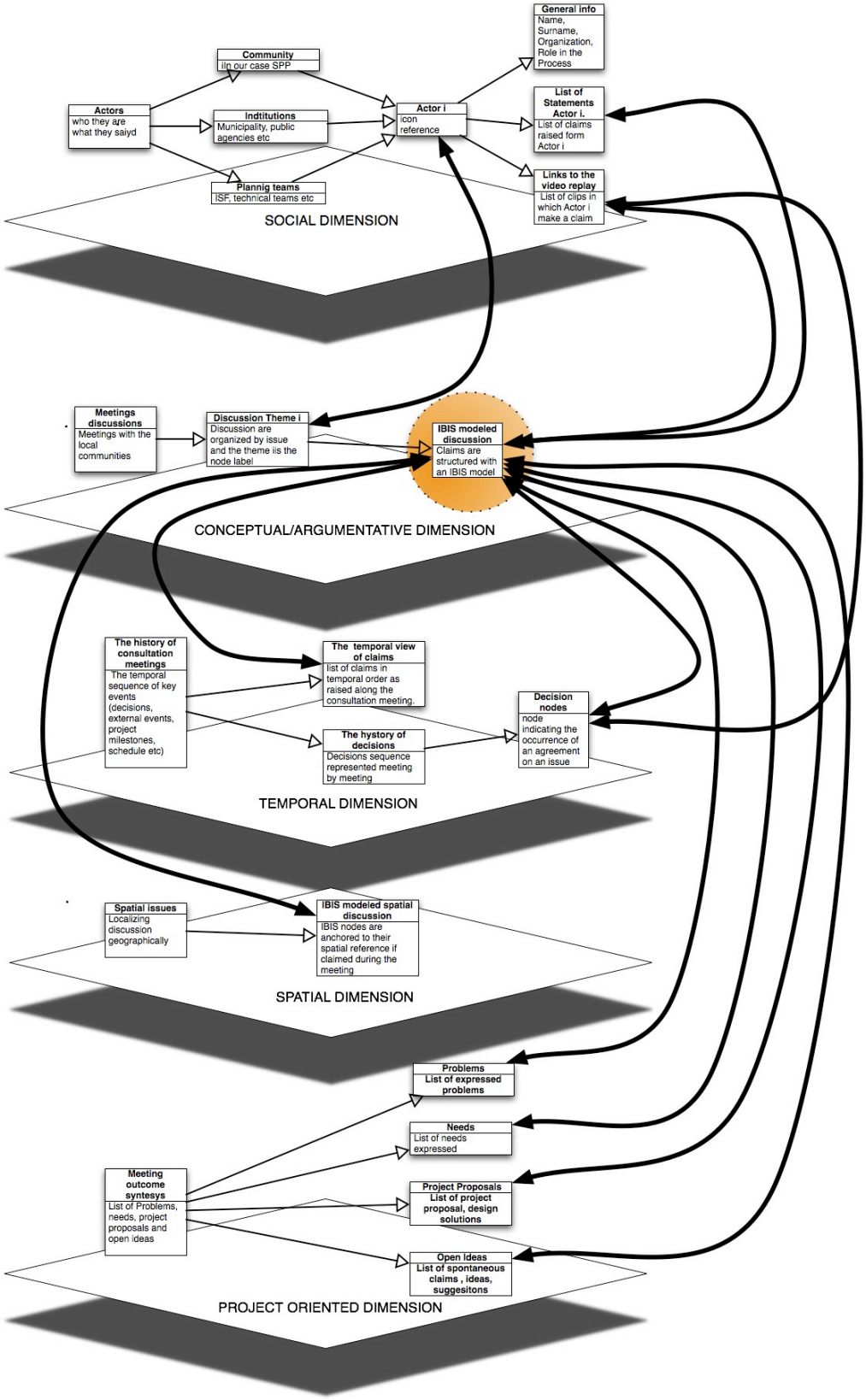

Figure 9-4: Information Architecture

9.5.1 Social Dimension

In the social dimension we can explore deliberation process looking at participants, that is to say we represent and organize the contents by contributor. This means that a user that want to explore SPP process memory starting form the social view will explore discussions and contributions by organization and by author. The following figure shows the two levels of agent or stakeholder: *collective* stakeholders and *individual* stakeholders.

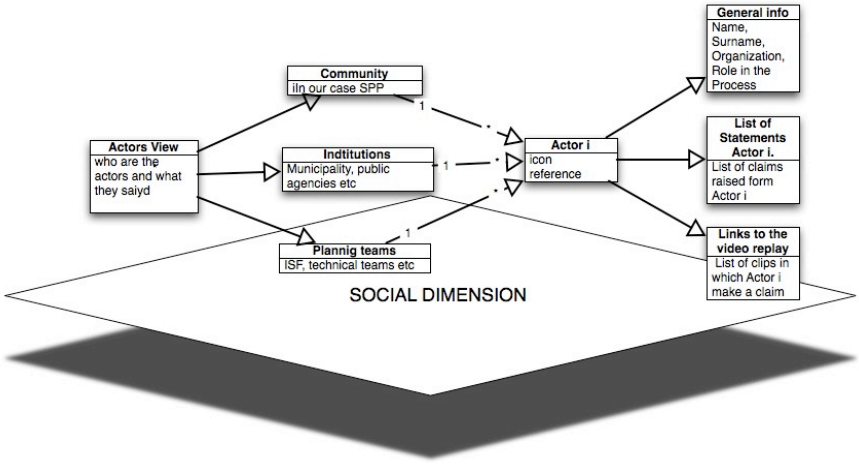

Figure 9-5: Social Dimension Information Architecture.

Each box in the figure represent a 'view' in the system that is to say a window containing certain information that the users can read and explore. Each link in the figure represent an hyperlink in the system that is to say an action that the user can perform to access a new view (window containing other info). The first information level describes the collective stakeholders:

- *Community* (in our case SPP)
- *Technical expertise* (expert and planning teams)
- *Institutional levels* (levels of government agencies).
- *Organizational affiliation*.

The second information level shows author by author:

- *Personal information*; i.e. name, surname, organizational affiliation, role in the process, work, etc
- *List of personal statements*, that is the list of contributions raised form that author
- *Links to the video replay*, that is the list of clips in which the author made a contribution.

Black links in the figure show all possible exploration actions/paths that the users can explore to access the information layer by layer. As we can see one of the links in Figure 9-5 is a relation one-to-many, because every organizational layer can contain more then one organization and each organization can contain more than one actor. In the following section well show some real application in order to clarify with examples what an exploration path can look like in the system.

9.5.2 Conceptual/Argumentative Dimension

The conceptual view is called Conceptual/Argumentative view because it focuses exploration of participants' meaningful contributions to the deliberation, as modelled by the planner in the IBIS argumentation scheme. This dimension comprises two information levels (Figure 9-6).

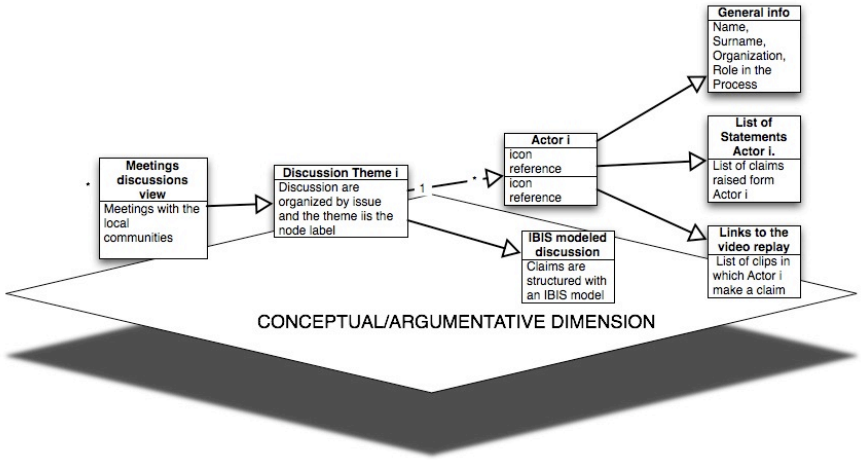

Figure 9-6: Conceptual/Argumentative Dimension Information Architecture

The first level describes the discussions by topic. Each discussion is grounded in a root Issue, which is either the actual question raised by the moderator during the meeting, or an implicit question inferred by the knowledge manager to make sense of contributions raised by the participants but concerning similar issues. The knowledge manager, when building this view, performs two operations:

- He isolates discussion and grounds each discussion in a root issue.
- He clusters all unrelated contributions (defined as 'open ideas' in the previous section) by topic so that they can be easily explored afterward.

Discussions are usually easy to identify because they consist of coherent argumentation graphs — usually trees with a parent Issue if the IBIS model has been applied correctly.

The second information level provides links to the list of the participants in the discussion.

9.5.3 Spatial Dimension

Planning is intrinsically spatial. This dimension represents contributions as IBIS icons (Issues, Answers, Pros, Cons, etc), which are overlaid on a geographical map. As we can see in the next figure the spatial dimension has a single level information structure, modelling the scope of contributions as national, regional or local (Figure 9-7). If during the discussions stakeholders raised contributions which have a spatial relevance, and if they explicitly make considerations about spatial issues or spatial objects, the issue and/or spatial object to which he is referring to is represented on or anchored to the geographical location of the object itself. Although in related projects Compendium has been integrated with a Geographical Information System (GIS) (Berardi, Bachler et al. '06), for pragmatic reasons (lack of

programmer support, and relatively simple requirements for functionality), the present project simulated a GIS with static maps.

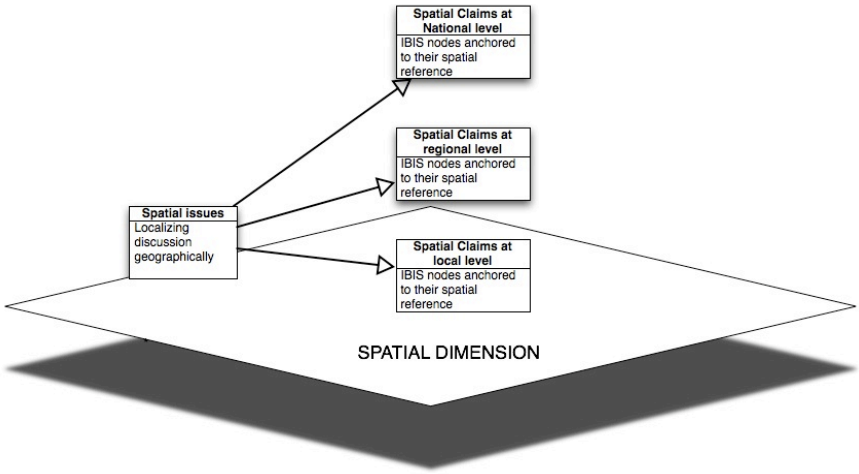

Figure 9-7: Spatial Dimension Information Architecture

9.5.4 Temporal Dimension

The temporal dimension focuses attention on when and in what sequence project events unfolded. The timeline shows: general contributions and special events such as meetings, decisions, project milestones, external events and project schedules. Contributions are organized by temporal occurrence within the meetings.

In the following figure (Figure 9-8) we can see the information architecture of the temporal view. This view has a two-level information structure. The first information layer distinguishes between contributions and salient events. The second layer visualizes contributions as a list of nodes ordered by time and salient events as chain of decision/event nodes linked following their time occurrence.

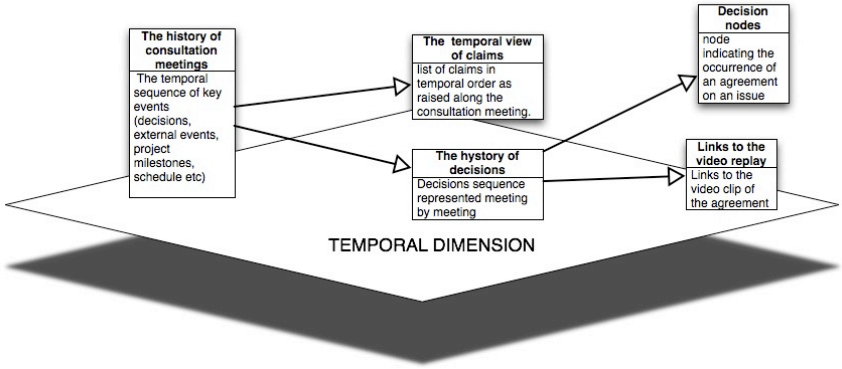

Figure 9-8: Temporal Dimension Information Architecture

9.5.5 Project-Oriented Dimension

The Project-Oriented dimension is so-called because it is organised around meeting/project outcomes. This view can vary its contents with the project aims. In our case the aim was to define problems and resources of the SPP neighbourhood. Thereby four tags were devised to express the role played by the contribution against the overall project/meeting objective (task within the project): needs,

problems, project proposals and resources. The information contents in this view follows the tagging scheme chosen to describe how the contribution fulfils the project/meeting objectives (see section 9.4.2). Thus, the project-oriented dimension gives a useful summary of deliberation results in terms of project aims. It can be a good starting point for the users who want to assess the current situation, and have a quick view of deliberation results. In the following figure the information architecture of the project-oriented view is described as a one-level information structure, in which contributions are listed by tag, as: Problems, Needs, Project Proposals and Resources.

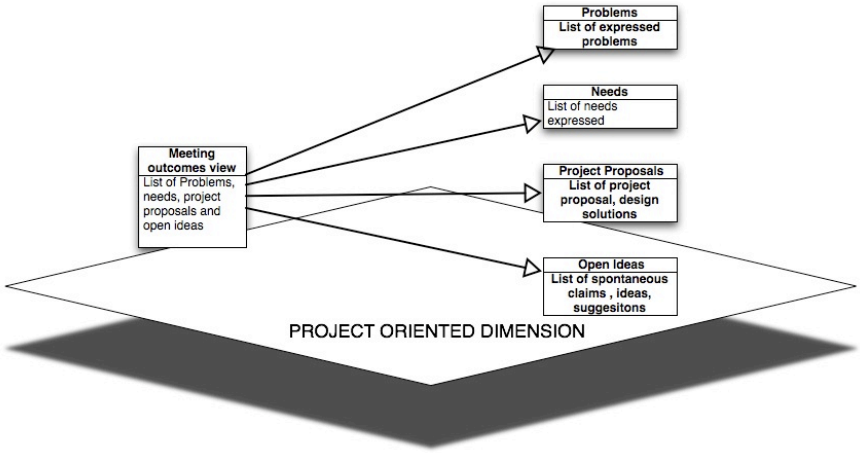

Figure 9-9: Project-Oriented Dimension Information Architecture

If we revisit the overall information architecture (Figure 9-4), the bold curves represent hyperlinks enabling navigational moves which 'traverse' the five dimensions. We can start exploring the memory system looking at contributions made by a specific participant and then we can focus on a specific contribution. Selecting the contribution we can then move directly to the conceptual view, this view will show the selected contribution in the context of argumentative discussion in which it has been raised (the selected contributions is underlined in yellow in the conceptual view so that the user can maintain the focus on the selected issue). In the same way we can look at the conceptual and social implications of geographical issues, by switching from the geographical view to the conceptual and social views. The possibility to traverse different contexts while exploring the same issue can support reflection about different impacts that the same issue can exert in several contexts. At the same way viewing different contributions focusing on a specific dimension can help to make sense of different issues regarding the same problematic context; i.e. issues related to the same geographical area, addressed to or raised by the same organization, came out in the same discussion. Furthermore links across contexts augment the number of paths that the user can chose to reach the same information. When exploring the system this feature should, at least hypothetically, augment the probability for the user to reach the information he needs to tackle his problem.

9.6 Information Representation: Results of the Group Memory Reconstruction

Compendium has been applied as Hypermedia environment to help ISF and the Planning Project team in charge of the project to capture, index, map and visualize connections between information, issues, options and arguments generated and raised throughout the consultation meetings. In the previous sections we described the modelling process and information architecture used to capture, index and represent information chunks (contribution) in the hypermedia database. Each contribution (where and when possible) has been represented in the five dimensions discussed in the previous section.

In the following images we show examples of system exploration of the five contextual views. Figure 9-10 shows the "home window" displayed when the user launches the SPP memory system. Contents in this view have been organized like a web page, with a left navigation bar, consisting of nodes (hyperlinks) which give access to other information layers.

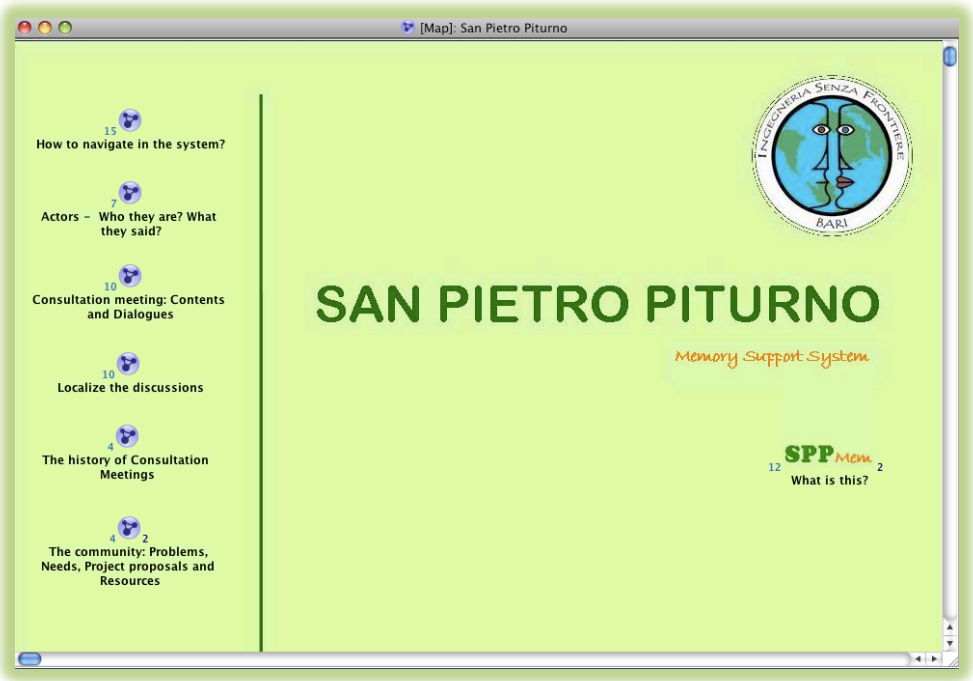

Figure 9-10: Home View of the SPP Memory System: SPPmem

As we can see in the image, starting from top left we have a first node labelled as "how to navigate into the system" from which we can access a general page with information on what is the system for and how to navigate into the system.

The following five nodes give access to the five contextual dimensions discussed in section 3.4:

- The Social dimension – accessed by clicking on the node labelled as: "Actors – Who they are and what they said?"
- The Conceptual/Argumentative dimension – accessed clicking on the node labelled as "Consultation Meetings - Contents and Dialogues"

- The Spatial dimension – accessed by clicking on the node labelled as "Localize the discussions"
- The Temporal dimension – accessed by clicking on the node labelled as "The history of Consultation Meetings"
- The Project Oriented dimension – accessed by clicking on the node labelled as "The community: Problems, Needs, Project proposals and Resources"

9.6.1 The Social Dimension

The social dimension describes who are the actors involved in the planning process and what they said during the consultation meetings (Figure 9-12, Figure 9-13, Figure 9-14, Figure 9-15).

The social dimension is represented by a set of hyperlinked views that provide the users with different exploration paths. The navigation paths mirror the information architecture described in section Figure 9-5. Here below you find results of the implementation of the information architecture in Compendium for SPP case:

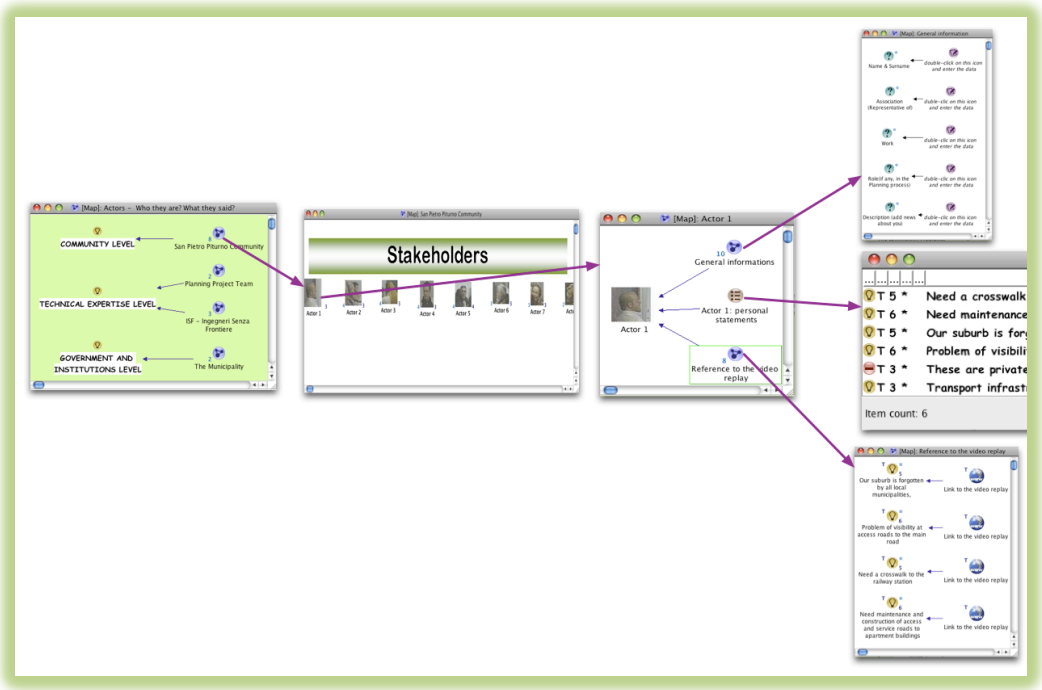

Figure 9-11: Social View Exploration Path

This view shows information about the organizational context in which the participatory process developed, in particular what are the organizations involved and at which organizational level they belong. Users ones chosen the organization that they want to explore can open the organization view. I.e. the "SPP community" map shows the stakeholders of the community (see Figure 9-13).

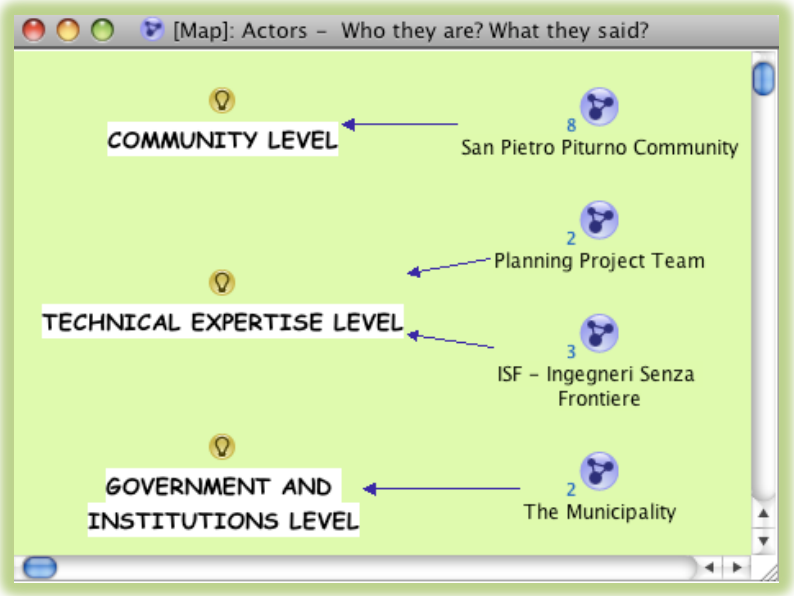

Figure 9-12: Organizational View: Organizations and Organizational Level

Figure 9-13: SPP Community Stakeholders View

In this view every stakeholder has a node with their picture, and a label showing hypothetically the actor name (in this case we just associate a number to every actor). If we click on the icon of one actor, i.e. 'Actor1' we visualize the single actor view shown in the next figure (Figure 9-14). This view give access to three information layers: personal info on the actor, list of personal statements of the actor and links to the video replays of contributions raised form the actor. This three information are represented in the following three images reported here below. Each view can be accessed clicking on one of the three icons labelled as: 'General information', 'Actor 1: personal statements', 'Reference to the video replay' (see Figure 9-15).

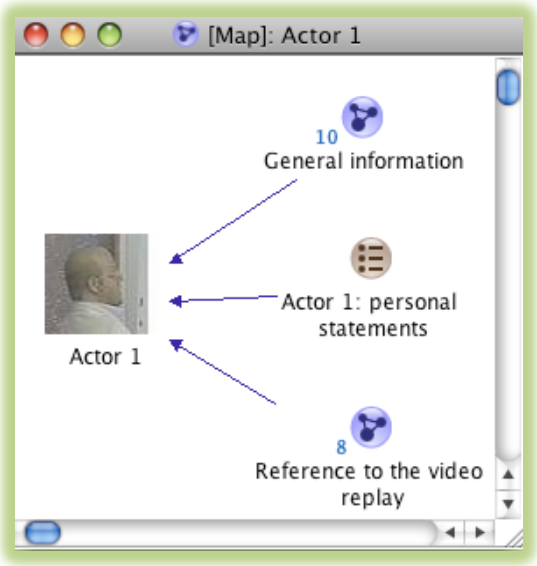

Figure 9-14: Single Actor View

The general information view consists of five fields: 'Name & Surname'; 'Association (Representative of)'; 'job'; 'Role (if any, in the Planning process)' and 'Description (add news about you)' (Figure 9-15). This gives a precise idea of the two organizational roles (within the community and within the project) that any user can play.

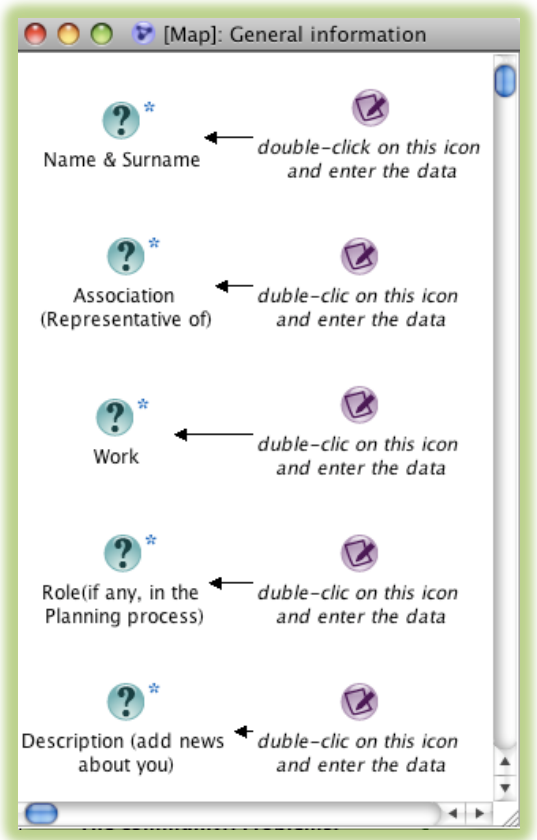

Figure 9-15: Single Actor's General Info View

The 'Actor's personal statements' view lists all the contributions made by the stakeholder during the consultation process (Figure 9-16). If in the process memory system there is more than one meeting, this list will contain all the statements raised across all meetings.

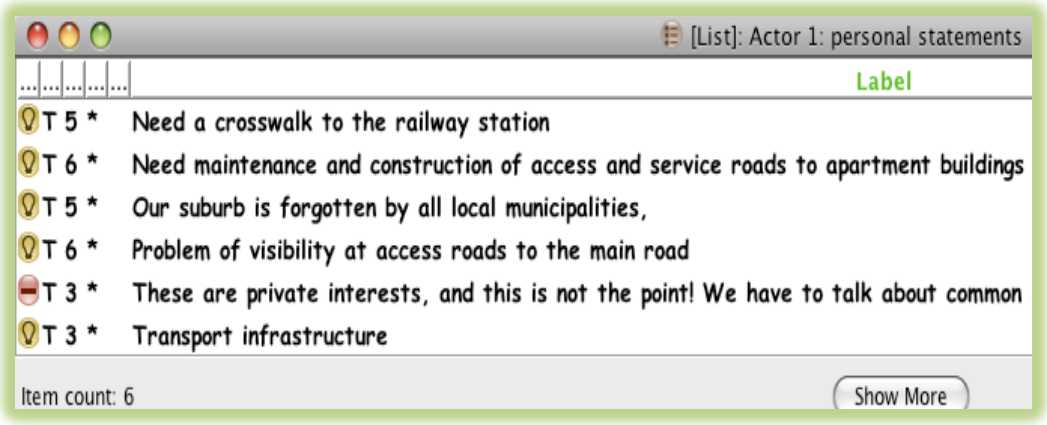

Figure 9-16: Single Actor's List of Personal Statements

Every statement in the list has three information elements: an icon, a number and a '*' symbol. The icon represents the IBIS icon that is associated to that contribution in the argumentative view. The icons associated to the statements give an idea of the kind of contribution that the stakeholders made, e.g. in Figure 9-16 the fifth contribution has a '–' icon indicating an objection raised to another contribution. Seeing that there was disagreement around that contribution we want to access and explore the contribution in the discussion view. The number at the left of the icon represents the number of different views in which the contribution is represented (e.g. in the list at Figure 9-16 the node is present in three other views). More information about this views and access to the view can be reached by pointing the cursor on the number. A yellow pop-up menu appears (Figure 9-17) showing the views (corresponding to our information dimensions) in which the node also appears — that is, the different contexts in which it plays a role. The appearance of a given node in multiple views is called transclusion in hypertext and it has been described in section 6.3.2.

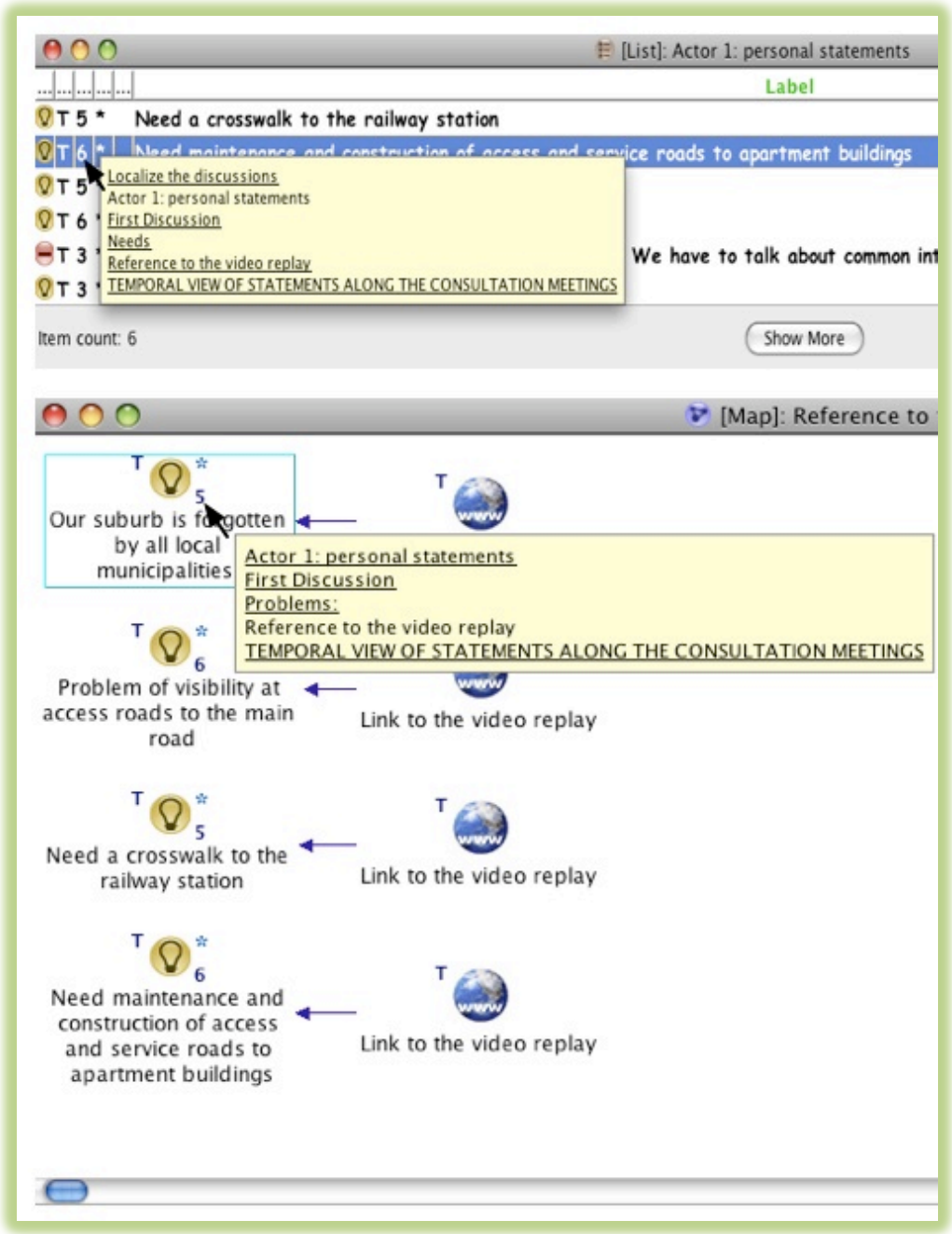

Figure 9-17: Transcluded Nodes: Exploring the Several Dimension of Each Node

Each element of the list in the yellow pop-up windows is the label associate to a view in which the node is present. In Figure 9-17, if we select the second contribution and we roll the cursor over the number 6 the yellow menu appears showing six links: 'localize the discussion'; 'Actor1 personal statements' 'first discussion' 'needs' 'reference to the video replay' 'temporal view of statements along the consultation meetings' (the non-underlined link refers to the currently open view). Clicking on each menu link open the corresponding view, and highlights in yellow the transcluded node, so that the user can easily identify it in the new context (see Figure 9-18).

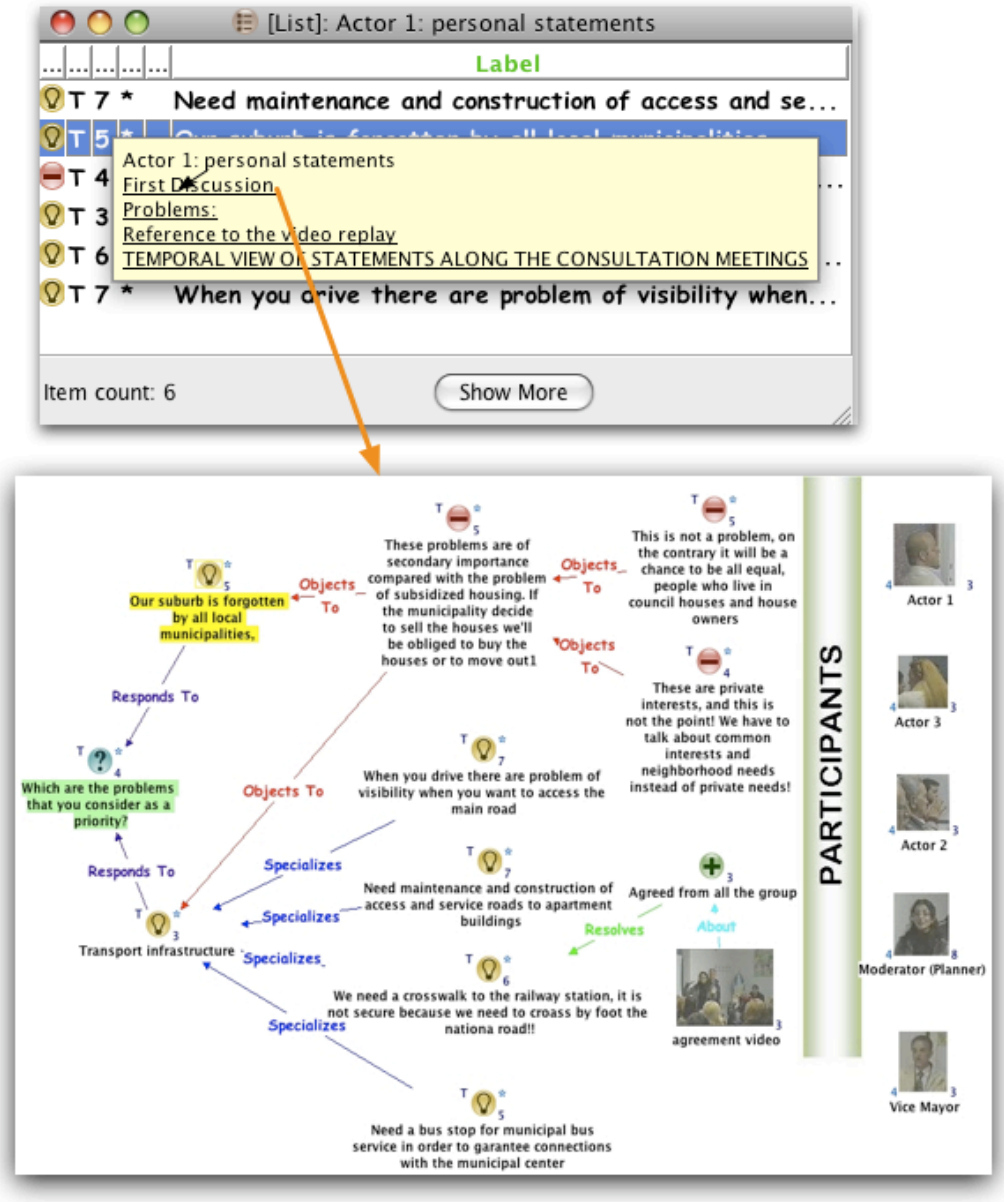

Figure 9-18: Example of Transclusion: Jumping from the Social to the Argumentation View

Using the transclusion feature users can traverse different views and the five different dimensions of the information architecture by jumping from one to the other.

As we can see in the yellow pop-up windows in see Figure 9-18, one of the view in which the nodes is transcluded is called " Reference to the video replay. This is the result of the integration between Compendium and FM (see section 6.4). Videos of the meeting have been annotated with FM following the single-track annotation procedure (see section 6.4.3). This allowed to link the nodes of the claim to the index to the video replay in FM. Opening the view we access the list of reference nodes which point directly to the FM video replay to the moment in which each

claim has been raised. Figure shows an example of the hyperlinks between Compendium reference nodes and FM video recording.

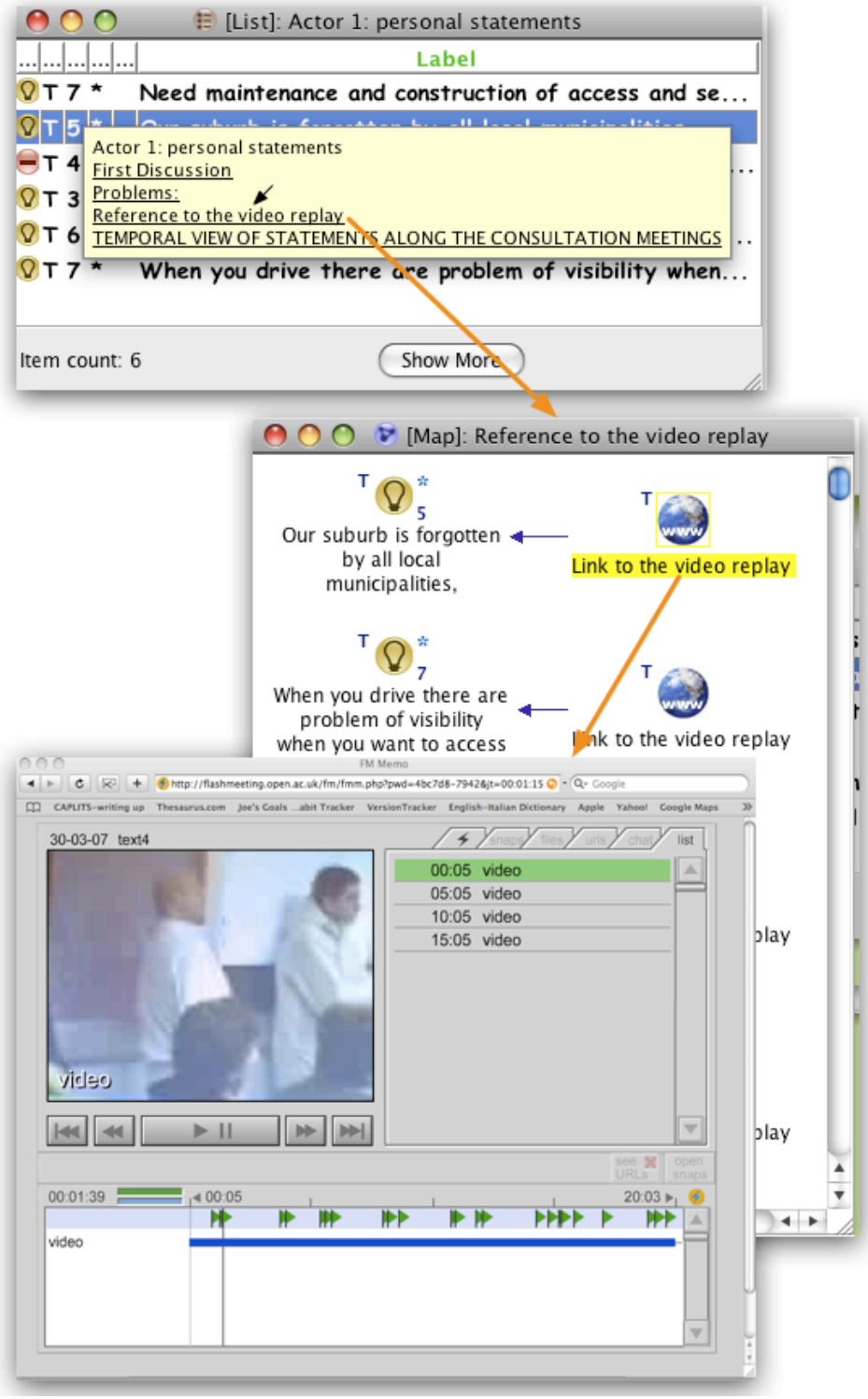

Figure 9-19: Integration between Compendium and FM

9.6.2 Conceptual/Argumentative Dimension

The conceptual/argumentative dimension shows the list of the discussion. Each discussion is associated to a node question describing the discussion topic. By clicking on one of the discussion users access the view with the IBIS representation of the discussion (Figure 9-20). The representation follows the IBIS model described in section 9.4.1. This view allows exploring the meeting contents following the argumentation rationale.

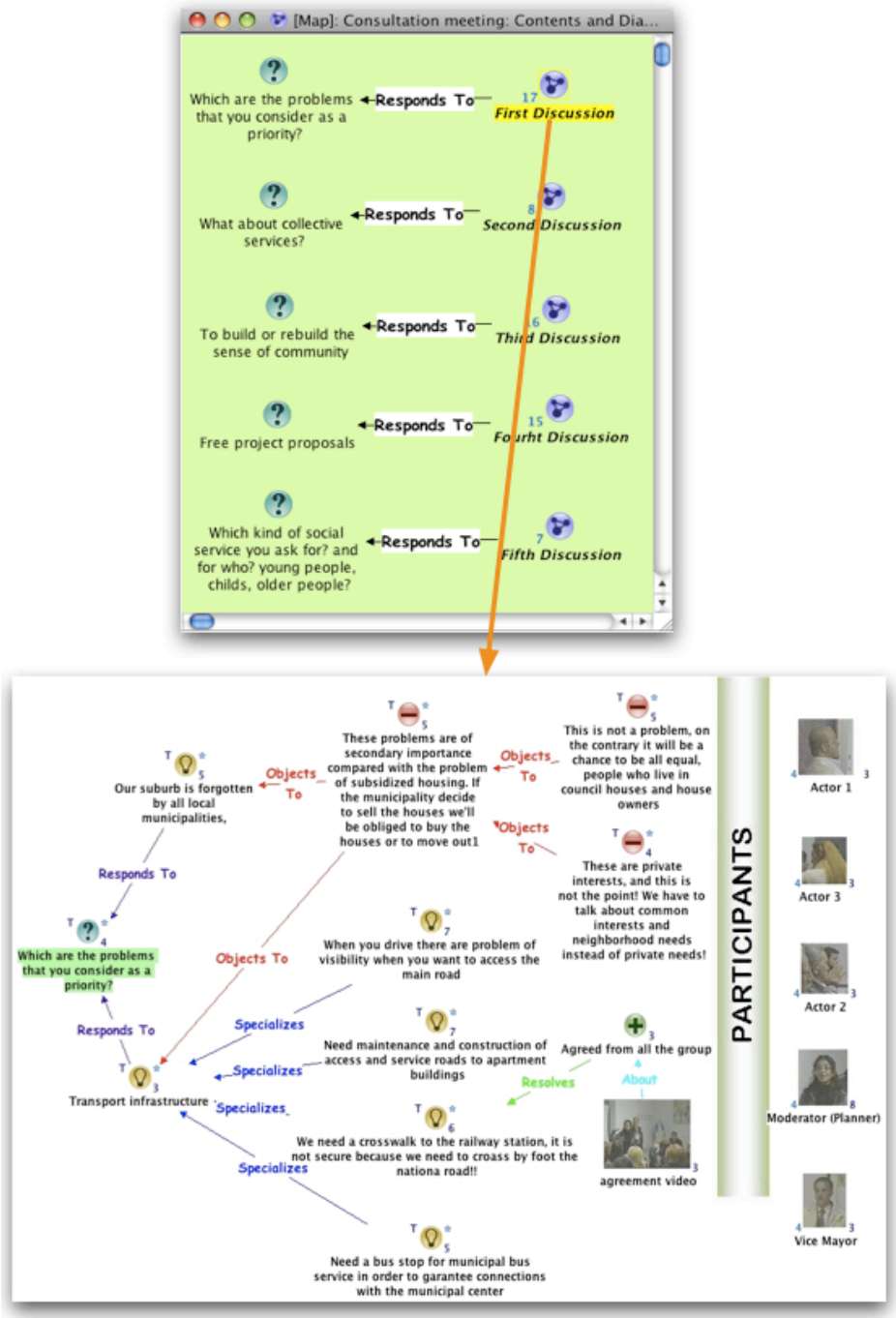

Figure 9-20: Conceptual/Argumentative Dimension Views

The map shows how from the initial question the different answer/alternatives emerged, and then it allow to see what have been the counterargument raised and by who. As in the previous cases pointing to the right dawn number users can access the yellow pop-up windows and access one of the other views offered by the system. If we in example we zoom in the argumentation view (see we can read that the node labelled: "*When you drive there are problem of visibility*" If is present in other 7 views. These views represent at the same time information on the claim (i.e. it has need raises by actor one, in the first discussion, and it is expression of a problem) and also seven different views/context in which the node can be represented and explored (i.e. Spatial view, Temporal view, Video replay etc).

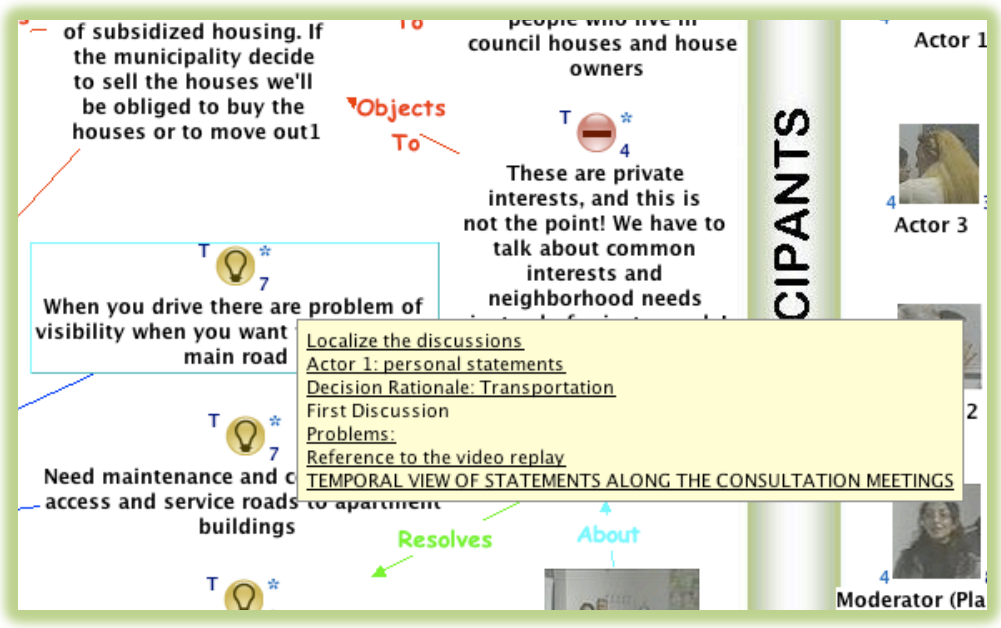

Figure 9-21: Hyperlink Between a Node in the Argumentation View and all the Other Relevant Views in Which the Node has Been Represented

Also double clicking on the Actor's icon we can access back the 'Single Actor' view of that actor (Figure 9-14). And double clicking on

9.6.3 Spatial View

The Spatial view is one of the most simple because it represents claims by anchoring them to the map and geographical area of interest of the claim. The spatial view can be either accessed by the home view (see Figure 9-10) or by transclusion from one of the other dimension (Social and Argumentative dimension, see Figure 9-17 and Figure 9-21) by clicking on the label " Localize the discussion". Clicking on the label brings the user to a map similar to the one shown in Figure 9-22.

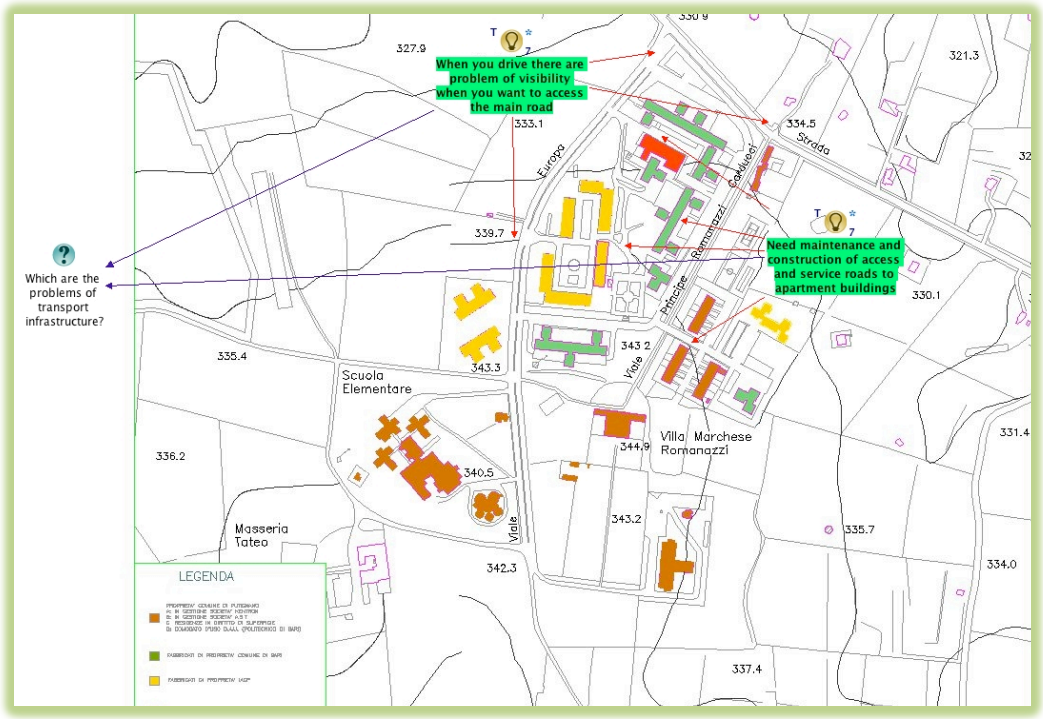

Figure 9-22: Localization of Claims Geographically

9.6.4 Temporal View

The temporal view has been organized in a set of views which focus on two temporal representations of key contents: Claims in the discussions and Decision taken. As discussed before decisions are key events that are registered by the Knowledge manager when an agreement occurs within the group. Decisions have been organized in temporal sequences within a meeting and can be explored meeting-by-meeting. The hyperlink to the index to the video replay is also associated to the decision nodes so that moment of agreement can be specifically replayed afterword. Temporal representation of decisions is shown in the next Figure 9-23.

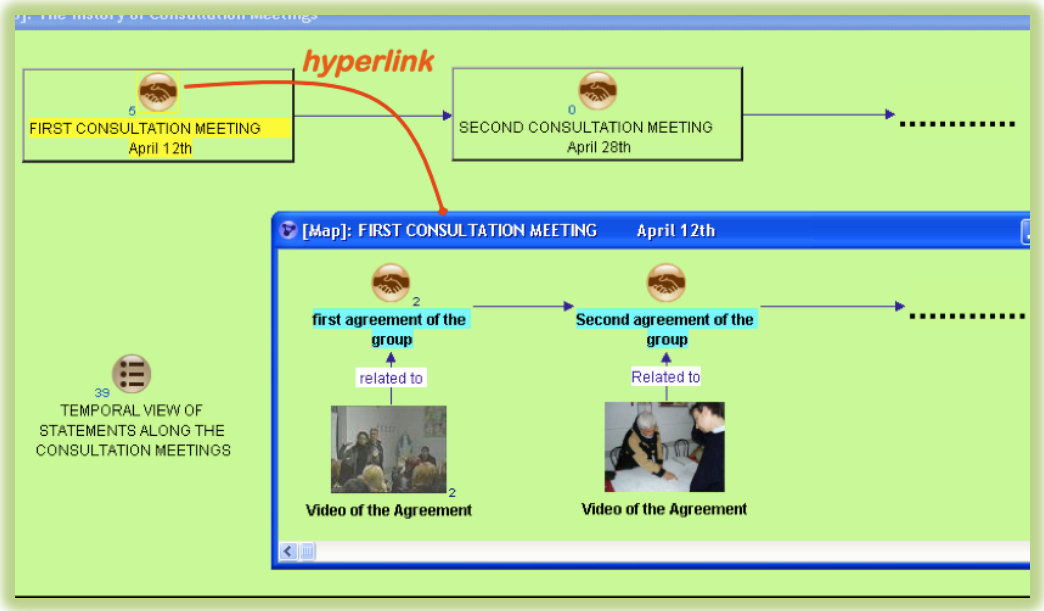

Figure 9-23: Temporal Dimension: When a Decision or Agreement occurs in the Planning Process

The second temporal representation regards all claims raised and represented in the memory system. A list of the temporal occurrences helps the users i.e. to see if a claim has been raised before or after a key decision was taken. It allows to verify when in the process a certain stakeholders started participating etc. All these kind of reflection and reasoning can be supported by the temporal view. Figure 9-24 shows the temporal list of statements.

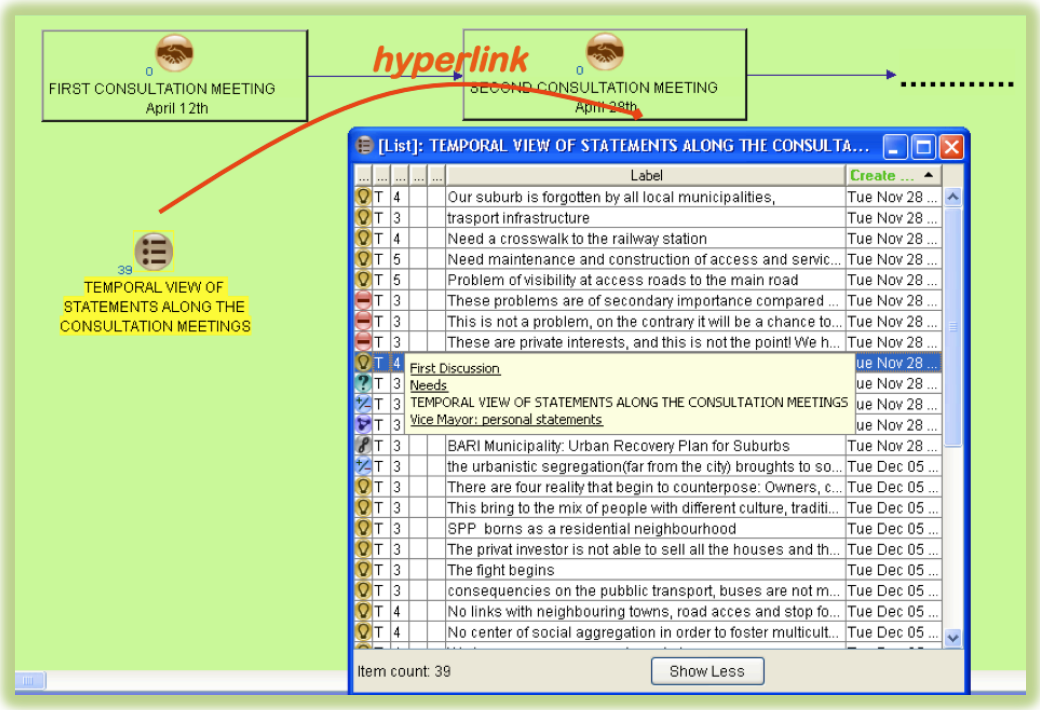

Figure 9-24: Temporal Dimension: When an Element Occurred in the Planning Process

9.6.5 Project Oriented Dimension

The project-oriented dimension is what we will refer to in the following as 'View of Summary' or 'Synthetic View' (see Figure 9-25). This is the view which represent all the claim but in relation to the role that they can exert within the specific investigation of the planning project. As discussed in section 9.4.2, for SPP case the consultation meetings aimed to explore what were the problem and priorities of the local community. Thereby a classification in four categories: Problems, Needs, Resources and Project Proposals have been defined for the specific planning case. The view of summary simply consist in the list of all the claims organized thematically in the four categories so that the users can starting exploring the meeting contents form a view of summary on all problems, resources etc that have been raised during the meetings. This dimension offers a different lens through which the users can explore the process memory platform. This focus on the specific meeting and project objectives and can be customized by the planning team according to specific needs.

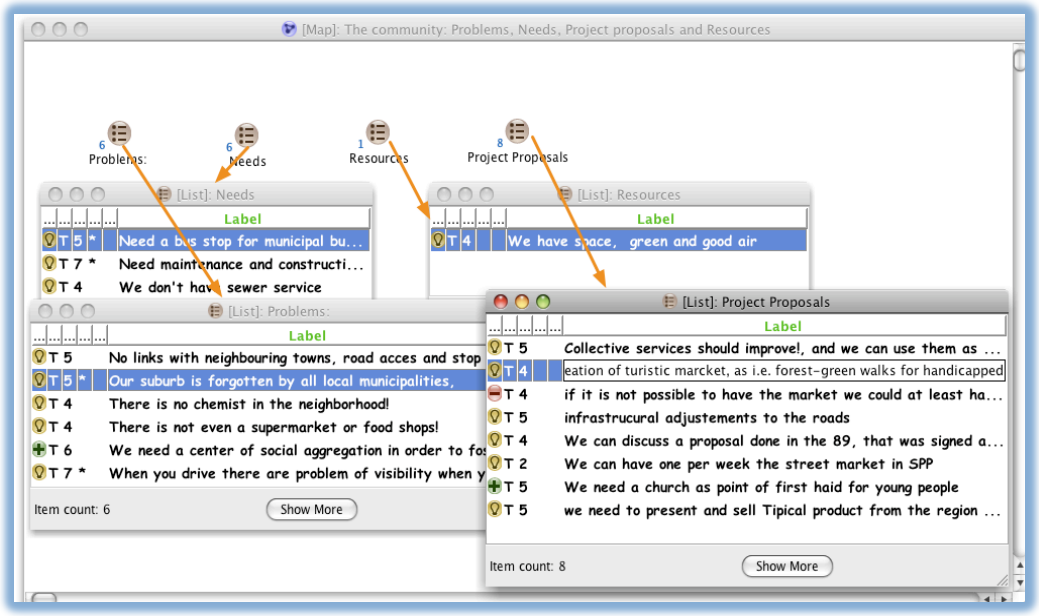

Figure 9-25: View of Summary: List of Project Proposals, Problems, Needs and Resources

9.7 Preliminary Evaluation and Discussion

A first preliminary evaluation of the SPP process memory prototype system concerned its expressive capability: did it capture and communicate the right information effectively? Two interviews were conducted with key actors in the consultation process: the consultant of the municipality, which was at the same time coordinator of the Planning Project teams, and the ISF director in charge of moderating the community meetings.

The interviews aimed to collect preliminary reactions to the system's expressive capabilities, and its points of strength and weakness. Both the interviewees were enthusiastic about the tool. The consultant envisaged using the tool to make visible and transparent the planning process in the final decisions. The ISF director was enthusiastic about using the tool to structure and reuse materials from past meetings with the community, using those as starting point for the following planning process.

These initial reactions will be enriched and reinforced with the deeper and detailed evaluation of the process memory platform presented in chapter 10. What we are interested to remark from this preliminary application is the explicit request to see example of application of the tool to trace design rationale.

The design rationale dimension was identified as key by one of the key actors in order to understand how meeting results subsequently influenced final planning design decisions. In the following we give an example of how the memory platform can be used as foundation to trace the design rationale

9.7.1 Memory Platform as Foundation to Trace the Design Rationale

In the virtual tour given of the system in section 9.6 we showed how the memory platform can be used to trace meeting contributions and transclude them across different dimensions. Although in SPP application we tested the modelling and representation of consultation meeting, it is still central in our goal to show how on the base of these representation of meeting contribution the process memory platform can support the planning team to trace and represent the design rationale.

As underlined from one of the interviewee in the evaluation phase, this is an important potential of the system that should be exploited and tested. ISF gave big consideration to community contribution but they did not explicitly motivate and describe the rationale of each decision starting from these considerations.

In the following we give two examples of how the connection between community contributions and planning solution in the actual planning process could be better represented with the support of the memory platform. Figure 9-26 shows a design rationale map that summarises one final planning decision along with directly transcluded contributions to show how they were taken into account.

The schema of representation is very simple: given a decision it question what are the pro and con for that decision and who supported or opposed to that.

In the example showed by the SPP case we see that four considerations have been raised by the community about the decision of "*Acquiring and recovering of one of the building of the neighbourhood for public services*". The process memory platform allows maintaining the links with the process memory contents so that starting from the 'design rational view' it is possible to jump to the other dimension views making sense of the claim and its different contexts. As we can see from the image the yellow pop-up menu allows to visualize who raised the comment and in which discussion, the discussion can be directly accessed and explored by clicking on the label. In this case there were no claim against the proposal.

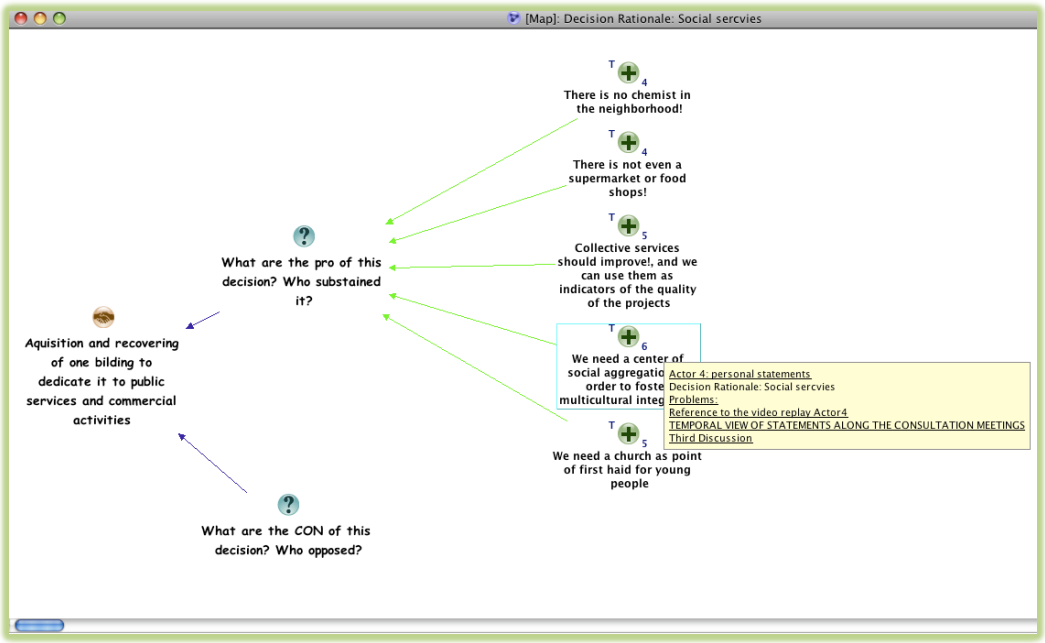

Figure 9-26: Design Decision on Commercial and Social Services: Representation of the Design Rationale

In Figure 9-27 we show another example in which one consideration has been moved against the design decision. In this case we can enlarge out knowledge representation schema questioning: "*Why this opposition has been neglected?*"

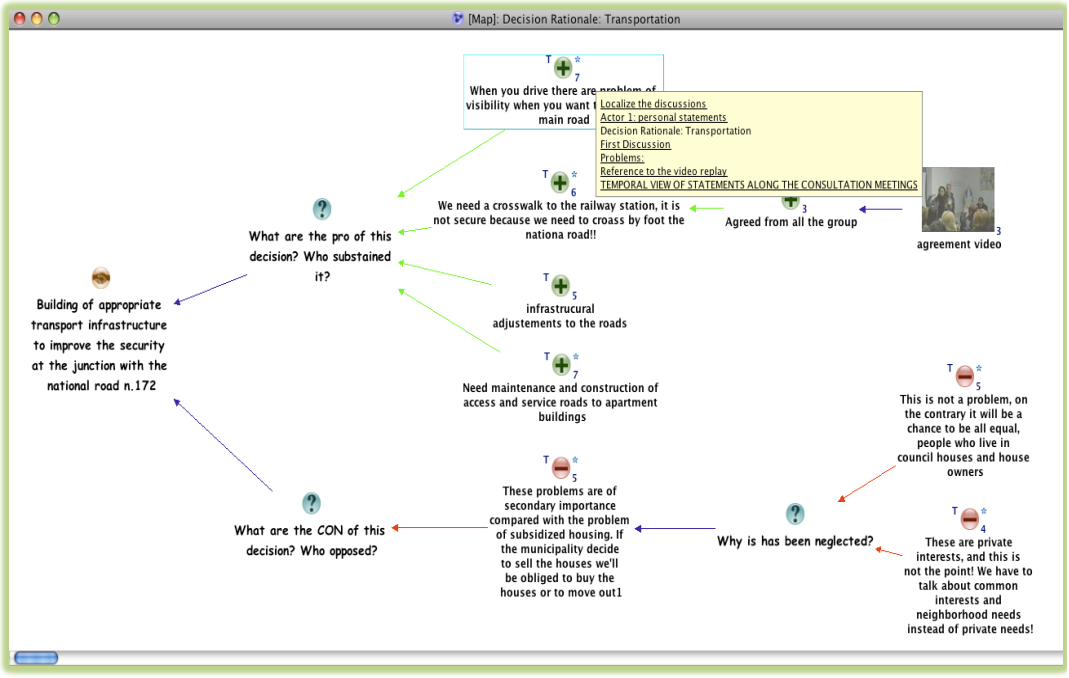

Figure 9-27: Design Decision on Transport Infrastructure: Representation of the Design Rationale

Thereby other argument can be added by the planning team or extracted by the community consideration to explain and justify the rationale of design decisions. In

our case we can see that two arguments have been given as reason to discharge the opposition to the design proposal.

The previous images give two example of how ISF and the planning team could have supported the representation of the design rationale by using the process memory platform. Of course for this to happen there has to be an intentional commitment of the planning team to tell the story of the decisions.

In the application to SPP case we applied dialogue and issue mapping of what specifically happened during the meeting. But much more can be done to enhance these contents and to build summary maps. These maps are built reflecting and analysing the meeting contents and they are built out of the meeting room. We showed one possible knowledge representation schema to trace design rationale maps. This is just one of the many discourse representation schema that can be directly build by the planning team to represent and disclose design rationale. What is relevant for our research is to show that the process memory platform provides the foundation, both in terms of information base and technical mean, to support planners to trace and represent design rationale. The process memory platform offers the planning team the information base and the mean to connect community contribution to final decision through a personal discourse schema that can be decide and customized by the team.

10 Testing Memory Exploration Activities: The Process Memory Platform Usability

This chapter focuses on the evaluation study that has been conducted in order to answer RQ5 and verify the effectiveness of the process memory platform. In particular we test the hypothesis we do that a Process-Memory platform can help to better represent, trace, and manage information and knowledge in participatory planning. In the activity of management we consider also activities of storing, retrieving and using information and knowledge created in the planning process. The evaluation plan is described and the data collection and analysis is explained, describing used methods and tools. Then we address RQ6 by describing and discussing potential and risks of the process memory platform directly envisaged by the users. Finally evaluation results and analysis interpretation are discussed within the wider research framework.

10.1 Research Questions

The following evaluation study has been conducted in order to answer to RQ5:

Is the participatory process memory platform effective?

We should remind that the main objective of the process memory platform is to trace the project evolution representing information and knowledge used and produced along the planning process. Thereby the evaluation aims at testing the hypothesis made that *a process memory platform can help to effectively represent, take trace and manage process knowledge in participatory Planning.*

We consider activities of gathering, analysing, storing, sharing, retrieving and using information and knowledge as part of knowledge management. Thereby objective of the usability study is also to test the memory platform in term of retrieving and reuse of information and knowledge.

The process memory platform we implemented is consisting of a knowledge management system (Compendium), which has been integrated with two other groupware (CoPe_it! And FM), in order to enlarge the gathered information and knowledge base of participatory planning processes. As discussed in section 5.6 the heart of the process memory platform is Compendium, which provides the knowledge management system in which all information and knowledge are integrated and represented describing the project evolution as a whole knowledge process. Compendium is the user interface of the memory platform thereby testing the platform usability means testing the users interaction and use of Compendium plus testing the retrieving of the information from the memory platform applied in a real planning case. As we discussed in sections 3.4, 9.4, 9.5 a specific knowledge taxonomy and information architecture have been applied in order to structure information and knowledge in the memory platform, thereby the process memory

performances mainly depend on: i.the chosen KM tool (Compendium); ii. the information architecture used to structure and represent information and knowledge.

Therefore we will focus on testing: i.the KMS usability (evaluating Compendium usability)and ii. the information architecture and knowledge taxonomy.

We will test the knowledge taxonomy indirectly by testing the process memory platform. In particular we will dedicate part of the evaluation study to a deep behavioural experimentation of user-system interaction under specific and complex tasks. The tasks have been designed in order to test the information architecture and knowledge taxonomy. By giving specific task the users have been driven to follow certain paths of exploration. We evaluate the effectiveness of the information architecture and knowledge taxonomy by observing their performances in accomplishing the tasks and by observing reactions to the exploration experience.

The following sub-questions guided the data interpretation and analysis:

Compendium Usability Study:

Qa: How people interact with the system? Qb: How do they use it to extract information about the process? Qc: Is the system easy to use and explore? Qe: What do people like dislike about the system?

10.2 Data Collection and Analysis

In the following we describe the second phase of our evaluation study that is consisting of two sub-phases: data collection and data analysis. In the following sub sections we will describe the experimentations driven for the data collection and the methods and tools used for the data analysis.

10.2.1 Data Collection

The evaluation has been driven conducting:

- Lab-based observations: Two pair, and four single behavioural observations of system exploration by the user; in order to explore the system capability to retrieve information about the project. Both conducted to new users and planning experts
- Semi-Structured expert interviews: Four semi-structured interviews to test general reactions and explore possible uses of the system for different tasks and different expertise. The interviews have been done to representatives of different organizational level (community, technical and political level) like ONG organization, Decision Making, Institutions and Spatial Planning domains in order to gather insights and opinions from different domain experts.
- Questionnaires: 20 Questionnaires to new users for testing system usability and information structure effectiveness

10.2.2 Data Analysis

Collected data have been analyzed with different methods and tools. Mainly three techniques will be used:

- Qualitative techniques: behavioural observation of system exploration by the users throughout movies annotation and analysis.
- Query techniques: semi structured interviews and questionnaires to users involved in the tool testing.
- Quantitative techniques: statistical analysis both of on data extracted form the behavioural experimentations and questionnaires answers.

The tree techniques are used jointly to answer to the main research sub-questions described in the previous section.

10.3 Behavioral Experimentation: the Interaction Analysis

The interaction analysis has been driven throughout video recording experimentation conducted with several users. The experimentation consisted of a lab-based observation under specific tasks.

This method has been used in order to gain deep insights into the process people go through with Compendium when exploring the planning process memory. Eight people have been recorded while doing this. Four of them have been observed alone and thinking out loud, while 4 people have been observed in pairs so they had to talk to each other during the experimentation.

Participants have been booked for about 2 hour each, they have been observed while exploring the system and accomplishing nine given tasks. A screen-caste including the audio record of the dialogues between the participant and the tutor have been recorded. Then the video has been transcribed and clips have been created and coded according with a first coding schema. This schema evolved across several versions up to the final one.

From now on we will call system user as participant to the experimentation. A tutor has assisted each participant. The role of the tutor is to prevent participants from misinterpretation and blocks in the exploration; the tutor can pose question during the experimentation and/or he can decide to give suggestions, to ask for clarifications or to answer to participant's questions.

10.3.1 Method

A shallow theory-driven evaluation has been driven (Chen '97; Donaldson and Gooler '03), in combination with a grounded theory method (Glaser and Strauss '67). This mixed evaluation methods allows to merge advantages of more structured evaluation methods like a theory-driven method with the in depth analysis and observation gathered with an idiographic study.

As in a shallow theory-driven approach we followed a pre-defined experimentation logic, which gave us the method to reflect and interpret the data. While the idiographic study allowed us to describe results and to understand the meaning of contingent and, often subjective, phenomena. Idiographic is a term coined by the philosopher Wilhelm Windelband to describe the approach to knowledge as ‘tendency to specify’; thereby an idiographic approach is usually a qualitative approach which focus on a complete and in depth understanding of one person (in psychology) and/or one single case (in sociology). The behavioural experimentation

we drove had exactly this objective to understand in details single users interaction with the memory system.

First essential task in the evaluation study has been making explicit why and how the experimentation is supposed to achieve its outputs and outcomes. The focus then turned to analyzing and investigating likely causal factors and/or alternative explanations for experimentation outcomes (i.e. describing user behaviours and reaction within the system exploration).

The experimentation logic has been built to analyze and interpret the experimentation data and consequently to drive its evaluation. In order to build the experimentation logic in the following section we list and describe for each question the objectives of evaluation and the hypothesis and assumption we made about experimentation results. The hypothesis we make express the experimentation logic. If users' answers are close to the experimentation prevision it means that the system testing was successful, that is to say that data structure is clear and project retrieval is easy for the users. This also implies that the experimentation logic is correct and adequate to explain users' behaviour.

If users' answers disproof the experimentation prevision it means that the system testing failed in some of its aspect: data structure may be not enough clear and/or project information retrieval has been problematic. The reasons for this failure can also be given to errors, unexpected factors or events that haven't been considered in the experimentation logic. In this case the evaluation results will bring to review the experimentation logic.

Given the experimentation logic, we then used a shallow grounded theory to analyze and code the videos records of the behavioural experimentation. The first coding schema was driven by preliminary reflections about what we were interested to observe, and how the experimentations should or could develop (as detailed in the experimentation logic). Then the behavioural observation coupled with the evolving coding practice will allow understanding the meanings of the prevision success/failures and explaining them. This will allow to describe and understand positive results and to contextualize then to the contingent situations.

10.3.2 Experimentation Logic

Nine tasks have been given to participants. Every task is considered as a separate stage in the experimentation in order to monitor evolution pattern and learning curve that participants follow.

In the following we list and describe for each question the objectives of evaluation and the hypothesis and assumption we make about experimentation results. This information shapes the experimentation logic and will be written in green italic. In the next section we discuss the experimentation results for each of the 8 participants to the experimentation.

Q1: What's the project about?

The first question aimed to understand to which level of details the contents are communicated. If the answer is detailed enough we can deduce that the system is able to communicate general info about the project.

Q2: Who are the stakeholders involved in the process?

In this first task we try to test if the user is able to navigate the system starting from the Actors' view. Indeed, same contents can be accessed from different views. Each view works like a content interface. The hypothesis we make is that focusing the task (and then the question expressing the task) on the actors' identification, the users will explore the home view looking for the Actors view. We want to test the exploration path Home view>Actors' view, verifying how good/bad the home view has been organized and how good/bad it assists the users in the system exploration and in the information retrieving.

Q3: Try to summarize what actor looks to be more engaged (key actors) and what they said.

Assuming that the user is proceeding in sequence the questions go deep in the exploration path and try to see if the users are able to reach nested information. The information the user needs to answer the question is not contained in the home view or in one of the higher view in the knowledge structure hierarchy. The hypothesis we make is that: The user in order to answer this question has to detect and use the system features that allow him to access nested information. This question then aims to test how deep the users went, at this point, in learning the system and how intuitive and effective is the knowledge structure for new users. This is a challenge for the participant. In fact, there are several ways to answer this question depending on the criteria the P. chooses to define what's a key actor. Our aim is to understand if the knowledge structure is able to support multiple strategies of exploration or, to put it better, if the system supports the P. in finding a satisfying answer despite the chosen criteria.

Q4: Who raised more problems? Who proposed more ideas?

This question brings the exploration deeper testing the capability of the user to infer and discover by exploring the system his additional tagging and icons features. In order to answer this question participants should go to the actors' view and then choose a organizational group and a single actor, then from the actors he should be able either to access the list of statements or to open the discussion in order to access the statements nodes and to read the contents. He should be able as well to recognize and make sense of the icons associates to each statement, and to read the tags associated to each statement. Of course this is just a hypothesis and one possible path (that is the fastest one because it if following the information structure). The hypothesis we make is that if the users are aware of all the system features and of the information structuring he should probably choose this exploration path to answer to the question. Of course many different factors can influence and bias this hypothesis.

Q5: Which proposal has been made? Can you tell by whom?

Q6: List the main problems raised from community. Can you tell by who each of them was raised?

In these two questions I tried to verify the easy to detect and use the synthetic view. So I tried to push participants to explore this view asking them specifically about proposals and problems. This time the focus is no more on the actors but on the statements and discussion contents. The hypothesis is that users in order to answer the question easily they should be able to open the synthetic view and then to open the different lists of project proposal and problems. Therefore, from each list they should be able to retrieve information about the actors and to recognize the type of statements in the list looking at the icons.

Question five tests the exploration path: synthetic view>proposal list

Question six test the exploration path: synthetic view>problem list

Q7: Can you identify and list if there are conflicts or divergence of opinion; and identify about what issues?

This question aims at testing the icon features and in particular the IBIS palette used for argument representation. Some of the icons refer to intuitive node meanings: i.e. a light bulb stands for idea/answer; question mark stands for questions. Other icons like + and – stands for  *(arguments in favour) and*  *(arguments against). For this particular task,*  *(CON) nodes can be used to identify conflicts, disagreements between stakeholders and negative sides of a statement, facts or idea. The*  *nodes are linked to this fact, problem or idea with a CON relationship that is represented as a red arrow bringing the label "objects to". Both CON icons and links are indicators that the user can use to answer the question without the user being obliged to read every single content of discussion.*

We want to understand if the icons and link label meanings (used to communicate additional knowledge about the node content) are intuitive and if users use these meanings to accomplish their task.

The hypothesis we make is that: the fastest way to answer question 7 is identifying the CON icons and interpreting them as conflict indicators; after that the user should be able to read and follow the CON links in order to paraphrase and understand the discourse and the disagreement issue.

Q8: Which is the geographical area of interest for the project?

Q9: Can you identify the main spatial problems in the neighbourhood? Can you identify them geographically?

These two questions aims at testing the effectiveness of the Spatial view for: i. locating the project geographically; ii. organizing and representing spatial arguments.

The hypothesis we make is that: in order to answer this questions the users should recognize, open and read the spatial view. In this case the exploration path is very easy (home view>spatial view), thus the user should be able to open the spatial view directly form the home list. The difficulty concerns the reading of spatial argument as represented in the view.

10.3.3 Interaction Analysis

As mentioned in section 10.3, the behavioural experimentation has been driven using a shallow grounded theory method and involving 8 participants. Participants were asked to accomplish nine tasks by exploring the SPP memory system. Each task was associated to a relative question. They were also requested to write down the answers to the nine questions (listed in the experimentation logic in the previous section) and to give a rate to evaluate the tasks/question difficulties. During the experimentation participants were assisted by a tutor. A screen-cast including the audio record of the dialogues between the participant and the tutor have been recorded. Then the video has been transcribed and clips have been created and coded with the support of a CAQDA software (Computer Assisted Qualitative Data Analysis tool) called Transana. Transana is an open source software designed to facilitate the transcription, management and analysis of digital video or audio data. Transana user interface is comprised of 4 main windows (see Figure 10-1): the video window that displays the video to be analyzed (up-right window in the figure); the visualization window that displays the waveform of the video (up-left window in the figure); the transcript window that provide tools for transcribing the video and the video transcript that have been generated (down left windows in the figure); and the data window that provides an overview of the structure of the data, such as clips list and coding scheme (down-right part of the window).

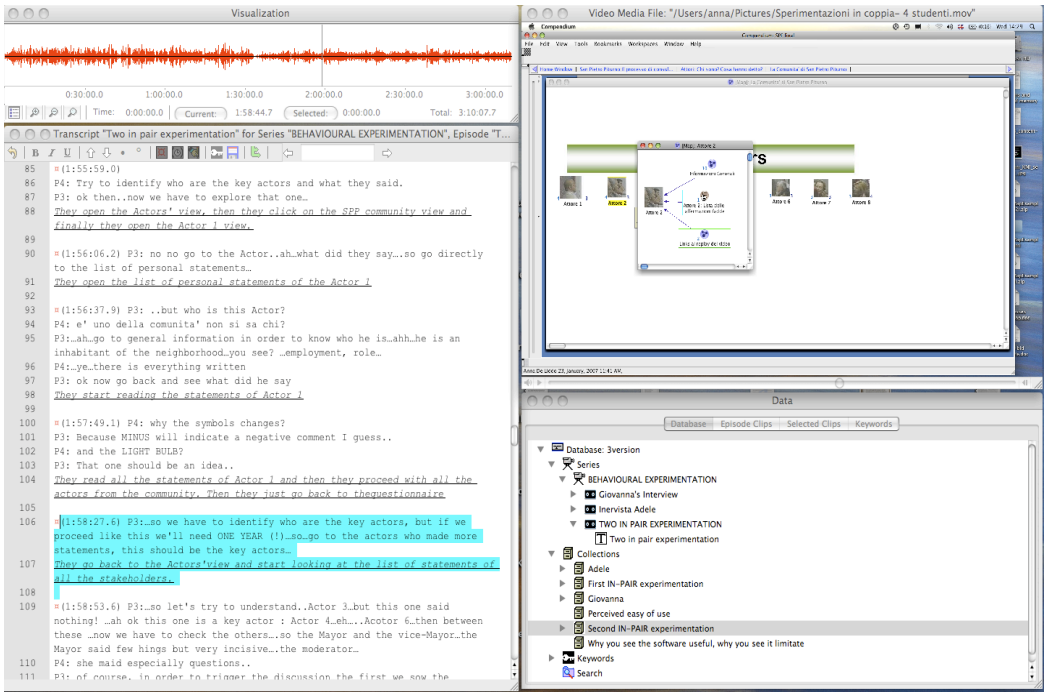

Figure 10-1: A Coding Session in Transana

We started our analysis transcribing the video. In Figure 10-2 (in blue colour text) we report an extract of the behavioural experimentation transcript as in Transana software. The text that is included in two time codes (time codes are written between round brackets) is associated to a movie clip. Significant statements from the participants are transcribed and associated to the participant's reference number (i.e. P1, P2…Pa etc). Whereas the statements reported in 'underlined italic' are notes and comment taken by the annotator during the coding process. Each clip has been associated to one or more codes which indicate relevant characteristics of the clip we want to observe. A first coding schema started emerging from data and then evolved in different new versions. Codes groups were continuously merged or moved to new codes' categories that the researcher considered as more appropriate to describe the phenomenon he want to analyze. The first open coding session served to break down the data, then the emerging concepts that proved their usefulness in the on going phase were conserved. The others were merged with more effectives categories or deleted. This way relevant data started to be grouped in relevant categories of analysis and observation. Of course the researcher cannot escape and should maintain "the perspective that will help him see relevant data and abstract significant categories from his scrutiny of the data" (Glaser and Strauss '67). The research for adequate coding schema can become very difficult if one hesitates to explicitly introduce theoretical knowledge. In our case our theoretical perspective is defined by the experimentation logic, this is the theoretical framework that helped us to identify categories and to relate them in meaningful way in order to explain the facts and phenomena we observed.

(1:55:59.0)

P4: Try to identify who are the key actors and what they said.

P3: ok then..now we have to explore that one…

They open the Actors' view, then they click on the SPP community view and finally they open the Actor 1 view.

(1:56:06.2) P3: no no go to the Actor..ah…what did they say….so go directly to the list of personal statements…

They open the list of personal statements of the Actor 1

(1:56:37.9) P3: ..but who is this Actor?

P4: It's one from the community, we don't know his role…

P3:…ah…go to general information in order to know who he is…ahh…he is an inhabitant of the neighborhood…you see? …employment, role…

P4:…yes…there is everything written

P3: ok now go back and see what did he say

They start reading the statements of Actor 1

(1:57:49.1) P4: why the symbols changes?

P3: Because MINUS will indicate a negative comment I guess..

P4: and the LIGHT BULB?

P3: That one should be an idea..

They read all the statements of Actor 1 and then they proceed with all the actors from the community. Then they just go back to thequestionnaire

(1:58:27.6) P3:…so we have to identify who are the key actors, but if we proceed like this we'll need ONE YEAR (!)…so…go to the actors who made more statements, this should be the key actors…

They go back to the Actors'view and start looking at the list of statements of all the stakeholders.

(1:58:53.6) P3:…so let's try to understand..Actor 3…but this one said nothing! …ah ok this other one is a key actor : Actor 4…

Figure 10-2: Extract from a Movie Transcript

Following the theoretical procedure mentioned above, we analyzed a total of 9.30 hours of videos and out of that we generated 412 clips. Each clip has been annotated with one or more codes, the initial coding schema included higher number of codes then we started merging and organizing codes. Four intermediate schemes have been generated, to end up with the fifth and final coding scheme which consists of 135 codes (see Appendix 1). Codes have been organized in a specific coding taxonomy consisting of 10 sub-categories of codes:

1. Question/task numbers;
2. Followed Strategy of exploration
3. Exploration Actions,
4. Explored views
5. User-researcher dialogue
6. Events
7. Impression from the Researcher

8. Problems and Suggestions stated form Participants
9. Software features recognized and claimed from participants
10. Encountered Usability problems

These ten sub-categories have then been organized by categories indicating the source of evidence (see. The first six categories of codes have been used to analyze and describe participants' exploration performances as 'shown by the video', that is to say as proved form their physical actions. Each exploration has been analyzed in terms of: performed task (this information tells about what 's the objective of the exploration that participants have in mind while exploring); actions performed with the tool (opening/closing a node, clicking a node to open a view etc), strategy of exploration (not verbally declared but proved form the video), explored views, interaction with the tutor (question/answers exchanged between tutors and participants), events (like getting stuck, overcoming a block or giving up). The second group of categories reports notes and opinions given by the tutor. When coding the researcher performs himself a process of understanding both of the process and the off the data, thereby he/she could feel like coding some relevant findings/understanding. We treated these codes as a separate group in order to be clear that they strictly refer to opinions/interpretation of the researcher. The third group of categories reports opinion directly claimed form participants. This group is considered the more relevant sub-category in the final discussion because it shows users evaluations explicitly claimed during the interaction.

Table 10-1: Codes' sub-categories organized by source

Describing Participants performances evidences from the video records	Question/task numbers;
	Followed Strategy of exploration
	Exploration Actions,
	Explored views
	User-researcher dialogue
	Events
Notes form the tutor- tutor's opinions	Impression from the Researcher
	Encountered Usability problems
Opinions/claims from participants – explicitly stated evidence	Problems and Suggestions stated form participants
	Software features recognized and claimed from participants

Each codes' sub-category consists of several codes for a total of 135 codes (to see the final coding schema refer to Appendix 1). In the following we show the codes' summary report generated by Transana. Each code is associated to one or more clips, for a total of 412 clips analyzed. Transana also supports complex clip searches by code, including using Boolean logical operators (AND, OR, and NOT). In this way it is possible to conduct deeps analysis on video data. I.e. we can search for clips in which participants got stuck. Transana will generate automatically the results and convert it in a collection of clips. A collection report like the one shown in Figure 10-3 will be generated.

The report describes the clips listing Clip label (which summarize clip contents), general info (like Participants, clip file location, time and length of the clip) and the codes (keywords) associated to the clip. Furthermore a Collection summary

indicates codes statistics (number of clips in which a certain code is present). The collection report supports several analyses.

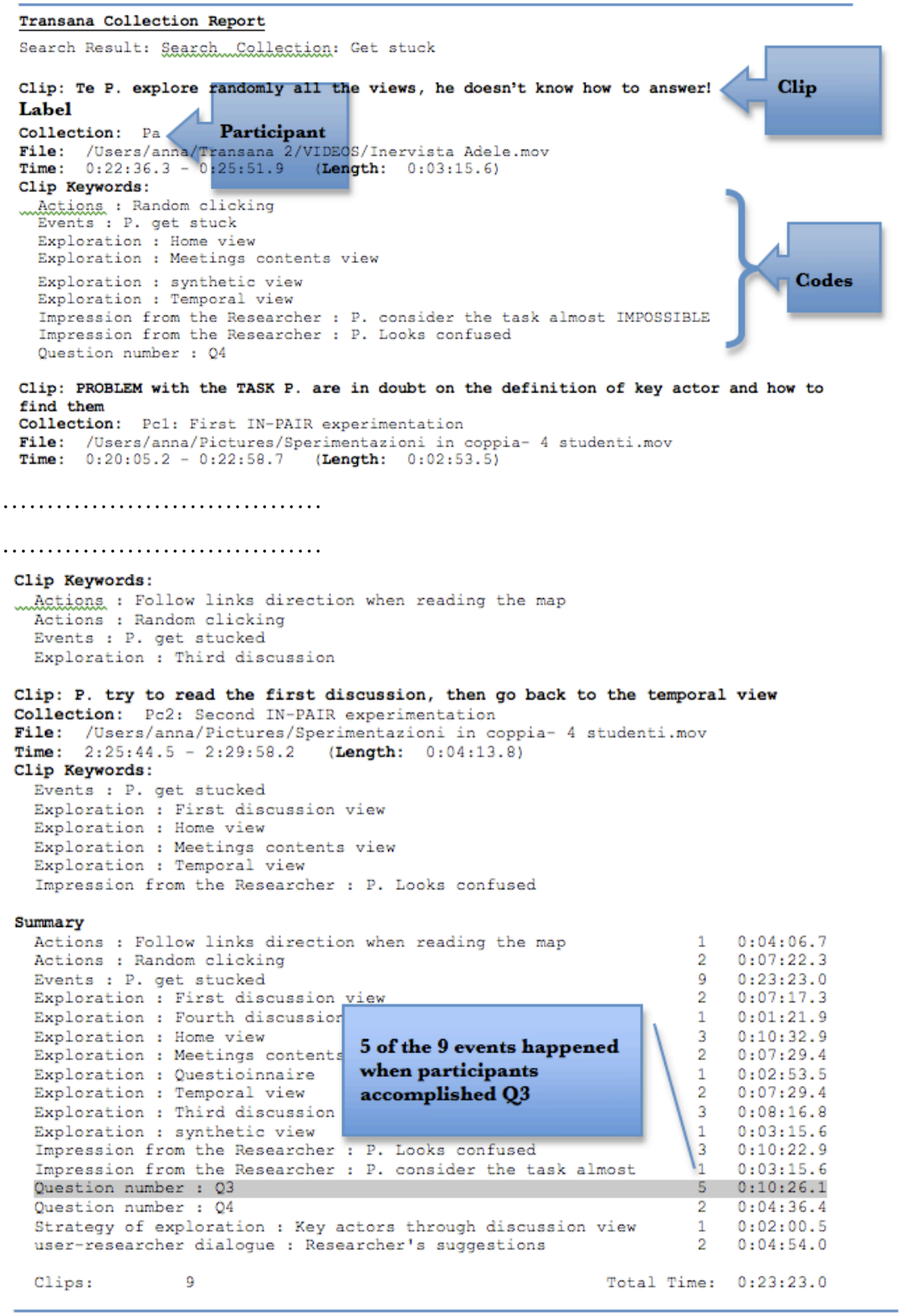

Figure 10-3: Transana Search Report

In example we can see that 5 of the 9 times in which the users were stuck they were accomplishing Q3, which give further evidence of the difficulty of the task itself. In particular they were trying to explore the meeting contents and in particular discussion 1,2 and 3. We can also see that the kind of action participants performed when getting stuck is either random clicking or trying to follow link directions to make sense of the diverse discussion. We reasoned in similar terms and we applied several search to test the hypothesis made in the experimentation logic. In the following section we report the results or the interaction analysis.

10.3.4 Behavioural experimentation: discussing participants' performances task by task

We draw six experimentation sessions of about one hour and a half each, of which four single and two in couple experimentations. Next table shows participants general info (name of reference, age, sex and education) Table 10-2.

Table 10-2: Behavioural Experimentation Participants

Reference N.	Participants Background	Sex	Age
Pa	PhD, Researcher	F	44
Pb	PhD, Institutional Practitioner	F	34
Pc1	Undergraduate Student	F/F	24/24
Pc2	Undergraduate Student	F/M	24/25
Pd	PhD, ONG Practitioner	F	34
Pe	Undergraduate Student	F	26

In the following we discuss, for the 8 participants and task by task, the experimentation results that comes from the analysis of the behavioural experimentation. The videos and the transcripts have been analyzed and the participants' behaviours and performances have been compared to the experimentation logic. The experimentation logic will be reminded at the beginning of each task in green italic and it is the reference to evaluate the performance results. Behavioural experimentation: discussing results

Q1: What's the project about?

The first question aimed to understand to which level of details the contents are communicated. If the answer is detailed enough we can deduce that the system is able to communicate general info about the project.

Pa doesn't find satisfying contents to answer the question. She just recognizes that it a process of consultation with a local community and that there are stakeholders involved but she doesn't understand that's the aim of these meeting and of the planning project. Therefore her rate is very low (R=1). Nonetheless while answering she was exploring the home view and she was able to perceive the information communicated from the first four nodes (Actors, Meetings contents, Spatial and Temporal view).

Pb: Since the very first moment of the experimentation with Pb it was clear that Pb was an expert of Information System for Planning. When thinking loud during the exploration she was able to refer to system objects using technical terms like nodes, icons, information layers, views, while the most of the other users were referring to the same things like: statements, images, pictures, maps, pages etc. Pb followed a different exploration strategy compared to the other participants. She decided first

of all to explore all the views in order to have an overall understanding of the system. This caused a delay in the time she needed to accomplish the first task. Like Pa when answering the question: "What's the project about?" she interpreted the question being referred to the planning project and not to the Compendium project. Nonetheless because she preliminarily did a detailed system exploration, she was able to give a detailed answer to the question: she pointed out that the project was bout urban regeneration, that it was driven with the involvement of the community, and she also specified the number of consultation meetings.

Pc1, Pc2: The first and the second couple of participants of the in-pair experimentations, that we will call in the following Pc1 and Pc2 (first and second couple of participants) went both straight to the view of general information about SPPmem project. So they gave a very detailed answer on project aims and contents. They also answered pretty fast, compared to the other participants. The reason for this can also be that they choose to not explore the system previously but to answer directly to the questions (Pc2 did just a quick exploration of the spatial view under request of one of the two participant).

Pd: Pd answered this question in details by exploring the view "What is SPPmem", which is the view describing ICT system objectives and features, Thereby we can say she followed the experimentation logic and she answer successfully to the experimentation. Anyway she was partially unsatisfied from the quality of the information, because also in this case she was expecting to have general info about the regeneration project and not about the ICT project.

Pe: Pe opened directly the view which describe the system and what it is for, she read the view and answered to the question very quickly, she did not give too many details but she show to be fast and confident with the tool since the first try. She claimed: "*I would say this task was very easy!*"

Questions Q2, Q3, Q4 regard specific project information, this means that in order to answer to the questions participants needs to explore the contents of the memory system in progressively deeper details

Q2: Who are the stakeholders involved in the process?

In this first task we try to test if the user is able to navigate the system starting from the Actors' view. Indeed, same contents can be accessed from different views. Each view works like a content interface. The hypothesis we make is that focusing the task (and then the question expressing the task) on the actors' identification, the users will explore the home view looking for the Actors view. We want to test the exploration path Home view>Actors' view, verifying how good/bad the home view has been organized and how good/bad it assists the users in the system exploration and in the information retrieving.

Pa: Pa showed to be quite skilful and at the second question she was already navigating fluidly across the actor view and the nested views describing different organizations involved and single stakeholders profile. She was able to make a list of all the participants specifying numbers and organizational affiliation. The exploration path she followed is Actors-Organization-Stakeholder. Her behaviour followed the prevision; no usability problems have been encountered; and she rated the facility of the task as 5 (5=very easy). We can then conclude that in this case the system supported the participant effectively. In the case of Pa, information turns out to be visible and easy to find; and the system easy to explore.

Pb: Pb answered the question really fast, she had no problem to identify and explore the actors view and she enumerated the number and even the organizational roles of the different stakeholders. We can then argue that so far the knowledge information architecture effectively supports participants in system exploration and information extraction.

Pc1 and Pc2 answered pretty fast to this second question but they decided not to enter in too many details and they just specified organizational groups involved in the project. Pc1 opened the stakeholders vie just for the planning team. The exploration path they followed is Actors-Organizations-Stakeholder. Pc2 stopped the exploration to the Actors' view. Thereby their behaviour followed the prevision; no usability problems have been encountered; and they rated the facility of the task as 5 (5=very easy). We can then conclude that in this case the system supported the participant effectively.

Pd: Pd answered this question very easily, she followed the experimentation logic and she went directly from the home view to the actors view.

Q3: Try to summarize what actor looks to be more engaged (key actors) and what they said.

Assuming that the user is proceeding in sequence the questions go deep in the exploration path and try to see if the users are able to reach nested information. The information the user needs to answer the question is not contained in the home view or in one of the higher view in the knowledge structure hierarchy. The hypothesis we make is that: The user in order to answer this question has to detect and use the system features that allow him to access nested information. This question then aims to test how deep the users went, at this point, in learning the system and how intuitive and effective is the knowledge structure for new users. This is a challenge for the participant. In fact, there are several ways to answer this question depending on the criteria the P. chooses to define what's a key actor. Our aim is to understand if the knowledge structure is able to support multiple strategies of exploration or, to put it better, if the system supports the P. in finding a satisfying answer despite the chosen criteria.

Pa: Pa quickly decides that key actors are those that participate in more discussions. So to identify them she open the actor view and actor by actor read the information about which discussion they participate. She understands this going with the mouse pointer on the right number of each actor node. She interpreted this number how the number of discussion the actor contributes to. In this case then she misinterpret the system function. Despite this initial error of interpretation she then answer exhaustively to the question because she discover how to access discussions from the actor node (using the down-right number menu). So she finally answers the question exploring repeatedly the path Actors' view – organizational affiliation – single actor node – discussion. This is one of the most tangled paths; it stresses one of the system features that appear to be difficult to learn for the participants. Pa proved to have reached a god familiarity with the system and a good understanding of the knowledge structure it uses. She actually recognizes that the exploration path she used is actually tedious to explore and then, as we will see in the following question, she will go directly to the content she needs opening directly the discussions. Anyway considering our hypothesis we can claim that the system supported her strategy and allowed to reach the sleeked information even to the third learning/task stage.

Pb: Pb proved to be a very reflective and acute participant. She chose two strategies to identify the key actors: i. who raised relevant issues that afterward brought to agreement within the group; and ii. who made more project proposals. The system proved to support effectively the two strategies. In order to follow the first strategy she explored the system focusing on decision/agreement nodes, ones identified these nodes she traced back in the IBIS discussion the original issue that inspired that decision and she identified the actor who raised this issue as a key actor. She proceeded with these criteria to the exploration of all the discussions and she identified two key actors (one for each agreement found). For each actor she also detailed why she recognized him as being key. To follow the second strategy she went to the project proposal list in the "view of summary" and she reads project proposals and actors who raised them. This way she found out which actors made more proposals and identified him as key actor. Pb gave an exemplar case of how system features, if previously understood, can augment the effectiveness and easiness of the tasks at hand. The reason for this effective performance can be due to Pb's expertise and confidence with ICT, but also to the fact that, unlike the other participants, she chose to explore in detail the system before to start performing the nine tasks. Unlike the most of the users she decided to read carefully the contents of the view "how to navigate the system", thereby she had an understanding of node types, and right and left number menu. As we will se also in the following this will positively affects Pb performances augmenting the rapidity, and the richness of details with which she was able to answer the questions.

Pc1, the first couple participating to the in-pair experimentation encounters a major problem to accomplish this task. They have no problems in exploring nested information, on the contrary their first action in this cycle was to explore the path: Actors' view>Organizational affiliation>Single actor node>Discussion accessing the discussion view from the right number menu. The first problem they encountered was to choose a definition of key actors. When after a deep reasoning around discussion contents they decided to define as key actor the whole community of SPP they get stuck in summarizing what the community said. They explored in details all the five discussions; they also showed a good ability in reading discussion views following icons' meaning and links directions and labels. Despite this they were confused and suck and they were not able to accomplish the task. This is an interesting case in which despite the participants were able to explore the system without problem, despite they were able to access nested information and to reason about it, they were not able to accomplish the task indeed. Participants explicitly claimed that the system was effectively providing the answers, it was just a matter of tie to accomplish the tasks, they said: "*it is easy to find information, about who said what and when…..and also the questions, the solutions…the problem is just to report the answers, we just need time*". Also watching the video replays we could verify that they were not encountering any usability problem. Thereby we have to presume the cause of this block is due to the personal capability of the selected users and then we should consider this task too complicate for them. We can just report that the system did not help the users to overcome their block probably because of the task difficulty.

Pc2, the second couple of participants to the in-pair experimentation gave a good example of optimal, fast and fluid exploration of the system to retrieve the information requested by the task. They followed straight away the path

Home>Actors>Organizations>Single actor view. As the dialogue transcription can confirm, this is not a casual path but they are following a specific reasoning about project contents supported by the knowledge structure and the system features and aimed to the accomplishment of the specific task.

Pd: in order to answer this question Pd followed the experimentation logic and she followed the path Home view>Organization>single actor view>List of personal statements. Pd was the Moderator of SPP meeting so she had a direct experience, memory and understanding of the participatory process, thereby as we will se also in the rest of the experimentation, she explored the system with a double objectives: answer to the question and to retrieve the information she remember about the participatory process. She read the statements done form many of the community members, but at the end she decided to answer relying on her memory about the consultation meetings more then on the project contents represented in the memory system. We can then conclude that Pd was able to explore nested information and to reason about that, thereby form an usability point of view the system and the information architecture were able to support the tasks. The problem in this case was again the quality of the information. Pd did not find many of the information that she remembered: i.e. information about organizational roles of some of the people from the community. She expressed the need to distinguish between normal citizens and representative of groups of interest and social service organizations that, as she remember, played a key role in the process. She claimed: "*While many of the citizens took a provocative and complaining attitude against the planning group some actors had a key propositive role and these were the persons I recognize as key actors*". She would have like the system to distinguish between categories (i.e. old people, young people, child, housewife etc) and organizations (i.e. younger rehabilitation groups, old-age groups, community workshop organizers etc.) within the same community group.

Pe: Pe exploration performance was impressive and she followed exactly the experimentation logic. To accomplish task 3 she used many of the system features: i.e she moved on icons and numbers when reading the list of statements; she used the navigation bar to go back to the home view and then again to the actor view, she read the nodes for the different teams (community, planners, institutions etc), and the list of statements for all the participants, she used the left down number indicating the number of objects included in a view or list. Indeed, when the list of statements of a specific actor had a "0" she did not open the node because she understood that that actor did not say anything. We could guess this from some of her claims like: "*oh she don't say anything*" "*For example: I know that this number (she showed the left down number) means that there are 8...2...etc nodes inside this map...so I was checking if there are additional info like this or tags to underline that one of the actor has been more important then another*". We can conclude that while reasoning about the key actors she followed successfully the task by following the experimentation logic and also she proved to be very confident with the tool and fast in the answer.

Q4: Who raised more problems? Who proposed more ideas?

This question brings the exploration deeper testing the capability of the user to infer and discover by exploring the system his additional tagging and icons features. In order to answer this question participants should go to the actors' view and then choose a organizational group and a single actor, then from the actors he should be able either to access the list of statements or to open the discussion

in order to access the statements nodes and to read the contents. He should be able as well to recognize and make sense of the icons associates to each statement, and to read the tags associated to each statement. Of course this is just a hypothesis and one possible path (that is the fastest one because it if following the information structure). The hypothesis we make is that if the users are aware of all the system features and of the information structuring he should probably choose this exploration path to answer to the question. Of course many different factors can influence and bias this hypothesis.

Pa: This turned out to be the more problematic phase for Pa. At the beginning she thinks loud about her strategy of exploration and she seems clear. She proposes two ways: opening all discussions one by one, reading the problems and then seeing who raised them; ii. going directly to the problems list. She doesn't appear to be satisfied by none of the two strategies and she starts to explore randomly the system, thus she gets disoriented and stuck. The tutor needs to suggest her that she can open the single stakeholder view to access the list of statements. After that, she immediately overcome the block and then start reasoning about the different actors, what they said, she even starts reflecting on the different actors' personality:

"*Actor 4…she does a lot of reflections and she makes also proposals and gives ideas…not like the previous one. Who was him?...yes…Actor 1, he just talked about problems*"

"*Pd, mostly raised questions…of course…she is the moderator…*"

Going back to the hypothesis we made, we can see how Pa proposes two different strategies but not the hypothesized one. Indeed, she chooses the two exploration paths already discovered in the previous phases. None of this two strategy seems to satisfy her and she doesn't proceeds with any of the two. On the contrary when the tutor points the list of statements out to her; she immediately proceed without any problem.

This is a sign that the hypothesized path was the easiest and faster for the task (the hypothesis was correct), but it was too difficult to find for Pa. Nonetheless it was difficult to identify but easy to use. Indeed, she proved afterward to have no problem to use and explore the path in order to answer to the question. She also shows to be able to "*recognize and make sense of the icons associates to each statement*". And she finally uses them to answer the question in appropriate and detailed way.

What seems to be relevant of this experience is that the system support reasoning about single actors. It offers the possibility to explore the process looking at the single actors and to follow their actions, positions, and attitudes to problems and to people. I.e. Pa writes:

"*The major participated just to one meeting and his interventions are just oriented to inform the people about the answer the Municipality is already giving to the problems of the neighbourhood!*"

Pb: Pb did not follow the exploration logic and she didn't' gather information about problems and ideas through the actors' view; on the contrary she relied on the "view of summary" in which you can find the list of the problems. Exploring the list she identifies which actor contributed more to define the problems and she identified actor 4. As we will see in the following the participants that were able to identify the synthetic view were also able to answer much quicker to the questions. We can then take this as evidence that this view works effectively as higher-level lens through which navigate the contents. After Pb experience we discovered there

were another effective way to answer the question, going through the synthetic view. The synthetic view is the view in which information is represented grouped in four main classes: problems, needs, resources and project proposals. At this stage of the experimentation people who use this way to answer question 4 show to be in advance in the learning curve we hypothesized when designing the experimentation. This is of course a positive case which can be ascribed to several factors. In example the case of Pb is due to the combined effect of two factors: 1) a personal expertise in the ICT field, and 2) a better study of the system features done before to start to accomplish the experimentation tasks.

Pc1 was not focusing on this task; they were answering exactly like question three. They still seem stuck in their circular reasoning about discussion contents. This experience doesn't add anything to our analysis. We can again, just conclude that the system did not help the users to overcome their block probably because of the task difficulty.

Pc2 answer this question following exactly the hypothesis we made. They went to the Actor view and then explored actor by actor the list of personal statements looking for  nodes representing ideas. They proved both to be able to explore nested information and to reason about that using icons type and other system features like the left down number (they used the number to count quickly the number of personal statements in the list). We can then conclude that Pc2 is aware of main system feature necessary to accomplish the task and they understand and explore correctly the system structure.

Pd gave a vague answer to this question she did not engage any further with the system exploration. In fact, while answering the previous question she convinced herself that no information about the key actors she had in mind could be found in the system. Thereby she answers referring to her past understanding and memory about the process. We can then say that the result is invalid for our evaluation purposes.

Pe: Pe already proved when answering question three that she was confident with the two exploration path: actors' view> organizational group> single actor> list of statements and actors' view> organizational group> single actor> discussions. She was able to access the statements nodes and to read the contents and she proved to be aware of all the system features. Thereby she really easily and successfully answered Q4.

Questions Q5, Q6, Q7 aims to shift the participant focus from the "planning-project stakeholders' to the discussion contents. In order to answer these questions participants need not only to reach certain relevant information but also to reflect and reason about claims and contents of discussions.

Q5: Which proposal has been made? Can you tell by whom?

Q6: List the main problems raised from community. Can you tell by who each of them was raised?

In these two questions I tried to verify the easy to detect and use the synthetic view. So I tried to push participants to explore this view asking them specifically about proposals and problems. This time the focus is no more on the actors but on the statements and discussion contents. The hypothesis is that users in order to answer the question easily they should be able to open the synthetic view and then to open the different lists of project proposal and problems. Therefore, from each list they

should be able to retrieve information about the actors and to recognize the type of statements in the list looking at the icons.

Question five tests the exploration path: synthetic view>proposal list

Question six test the exploration path: synthetic view>problem list

Pa, Pb: Both Pa and Pb answer questions five and six very quickly. They both identified the synthetic view since their first random exploration, so they went directly to the view. They opened the lists of statements and used tags and icons to define authors and type of statements. They both looked very confident with the tool. They followed the hypothesized exploration path and used the hypothesized system features, thus answering the questions easily. This is also proved by the short time they needed to accomplish this task and from the high rate they gave to the 'task ease-of-accomplishment' (see Figure 10-4).

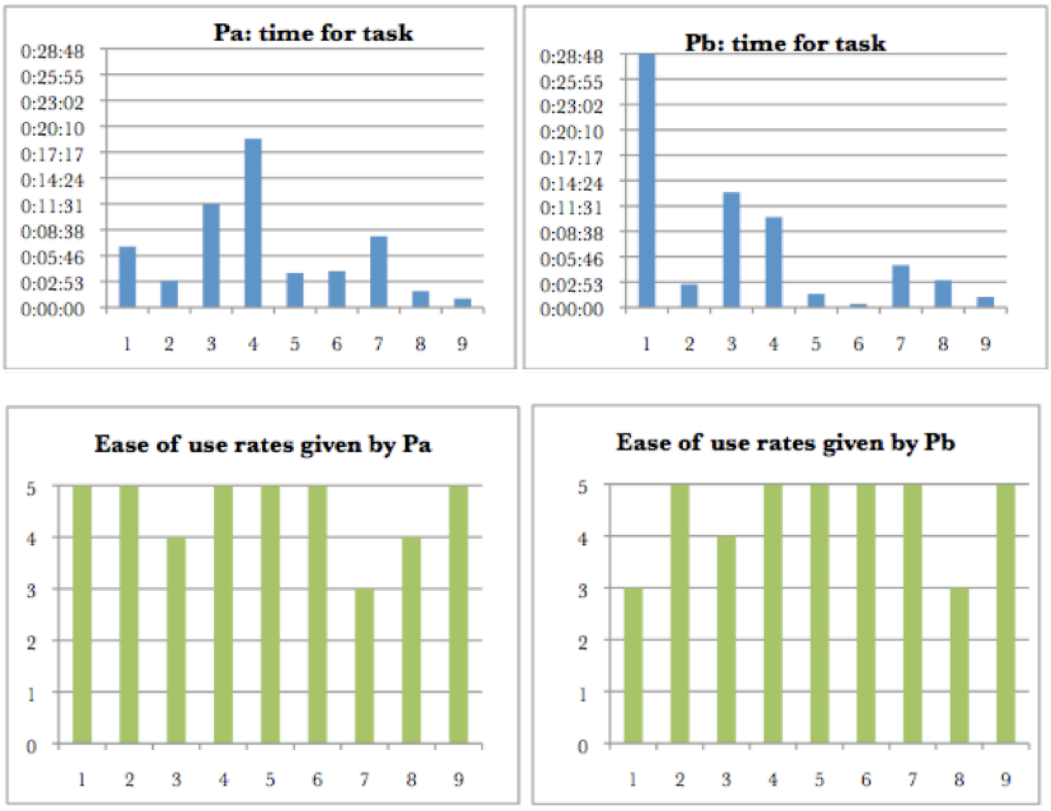

Figure 10-4: Comparison of Pa and Pb performances: times for tasks and Ease of use rates

Pc1 and Pd failed completely this task, they did not notice or open the synthetic view in their exploration. They then answered Q5 by exploring the contents of Discussion four in which the theme of discussion was: "Doing project proposal". So they just reported the project proposals coming out of that discussion. For Q6 they seek for problems by reading all the discussions one by one. This made their task quite hard. Still, from the analysis of the questionnaire we can say that the system supported them in answering the questions with quite rich details, but it is clear that the answers were not comprehensive and in particular they were not obtained by following the experimentation logic.

Pc2 followed the hypothesis made. They found the Synthetic view and then explored both the Problem and project proposal list.

The interesting thing of this case is that they claimed the need of a summary or index of statements by category; P3 says: " *Anyway… we would need a kind of index by category…well of course we have to trust the person who make the classification. but we would need an index…for ideas, problems….go there try that….what is that*?"

This need and the implicit assumption that the system would provide this feature pushed them to seek forward to find it. They went back to the home view in order to find a kind of index of the statements done by theme. And this is how they ended up to the Synthetic view. The claim by himself is an evidence that the organization of contents in a synthetic view and the organization of this view as a list of statements organized by theme is exactly what users need to easily retrieve comprehensive information about the project.

Pe: Pe succeeded in these two tasks. She was able to find the view of summary and to give really precise and detailed answers. Nonetheless she rated this question with a low rate because she could not find the view of summary straight away, by exploring the system. She discovered the view by reasoning, because she thought this could have been a good view to have in the system and then she went to look for it. She claims: "*I want to understand if there is a mean to gather the info but by theme...does it exist?*" after that she decided to go back to the home view and to look for a way to have info by theme, in this way she identified the view of summary. But she was not supported by the visual organization offered by the system. The synthetic view indeed is at the bottom of the navigation bar and, because the most of the users explore the nodes from top to down, many of them miss it. Anyway we can conclude that Pe accomplished the task very rapidly following the experimentation logic.

Q7: Can you identify and list if there are conflicts or divergence of opinion; and identify about what issues?

This question aims at testing the icon features and in particular the IBIS palette used for argument representation. Some of the icons refer to intuitive node meanings: i.e. a light bulb stands for idea/answer; question mark stands for questions. Other icons like + and – stands for PRO (arguments in favour) and CON (arguments against). For this particular task, CON nodes can be used to identify conflicts, disagreements between stakeholders and negative sides of a statement, facts or idea. CON nodes are linked to this fact, problem or idea with a CON relationship that is represented as a red arrow bringing the label "objects to". Both CON icons and links are indicators that the user can use to answer the question without the user being obliged to read every single content of discussion.

We want to understand if the icons and link label meanings (used to communicate additional knowledge about the node content) are intuitive and if users use these meanings to accomplish their task.

The hypothesis we make is that: the fastest way to answer question 7 is identifying the CON icons and CON links within the discussions and interpreting them as conflict indicators.

Pa: Pa first of all looks in the view of synthesis hoping to find a list of conflicts. She doesn't find it so she understands she has to explore discussions in order to detect the conflicts. She opens the first discussion and she tries to understand how contents

are organized. She mainly follows links directions and links labels to read the view. She identifies conflicts by recognizing CON links, but she doesn't notice or use CON icons. Anyway ones she discovers CON links she has no problem to answer the question, she explores all the views and describes in details all the conflicts, specifying actors and content of the opposition. We can then conclude that Pa followed successfully the experimentation logic to accomplish the seventh task.

Pb: Also in this case Pb gave a prototypical performance of the task. She recognizes CON icons and she explored the discussions looking for these icons. She also interpreted correctly the conflicts contents, which means that she was able to read and understand the IBIS map and make sense of the discussion dynamics. We can conclude that she followed the experimentation logic and accomplished successfully task seven.

Pc1 seems to have no problem with this task. They explored the contents discussion by discussion seeking for the CON icons and CON links. They then described conflicts and actors involved in the disagreement but they misunderstood the problem. Thereby again we can conclude that the system supported effectively in the task, but some limitation are due to the specific attitudes and capabilities of the participants.

Pc2 followed the hypothesis we made; they identified CON icons and interpreted them as conflict indicators but they had problem in reading and locating the CON nodes within the discussion flow. Nonetheless a simple suggestion of the tutor to focus on discussion view helped them to overcome the situation and they finally had no problem to describe in details conflicts and actors involved in the disagreements.

The hypothesis is incorrect because it doesn't consider the event that even if users understand icons meaning they could have problem in interpreting the discussion. In this case the problem concerns the capability to integrate different operations like:

- associating the meaning of the CON icon to the node content, then understanding that the statement means an opposition
- understanding to what the objection is moved to (this is performed by following the CON link that will link the CON node to the statement to which it opposes).
- proceeding backward until the disagreed issue is found.

This process is not easy at all, especially because the links direction suggests to reason looking backward (from right to left) while the flow of natural map reading usually moves forward from left to right. This difficulty is clearly stated from P3 who says:

"*This node objects to this one…and this one answer to this other one…it is from right to left! ….but we normally read from left to right and this is a problem!….I understand that I can get the meaning following the links…but this doesn't work!…*"

So the hypothesis should be correct this way: *the fastest way to answer question 7 is identifying the CON icons and interpreting them as conflict indicators; after that the user should be*

able to read and follow the CON links in order to paraphrase and understand the discourse and the disagreement issue.

Pc2 encountered some difficulties in reading the IBIS model of argument visualization. Reading IBIS structures is also a matter of personal skills (if you are not trained or confident with the IBIS syntax) and normally requires some training. The fact that Pc2 encountered problems to perform this task is not related to system usability problems but it's a matter of knowledge structure that has been chosen to represent discussions. This case give evidence of how can be initially difficult to face this different way of "reading" but we have at the same time evidences that, ones participants understand the way to read IBIS maps, The IBIS syntax can support a more efficient exploration of the contents (faster and producing more detailed information retrieving). We did a search for the clips in which participants showed to follow links direction, to read links' labels and to recognize node types (see Boolean search in Figure 10-5 *Actions: Follow links direction when reading the map* OR *Actions: Read/follow links label* OR *Actions: Recognize node types*) and we generated a clips collection report in Transana.

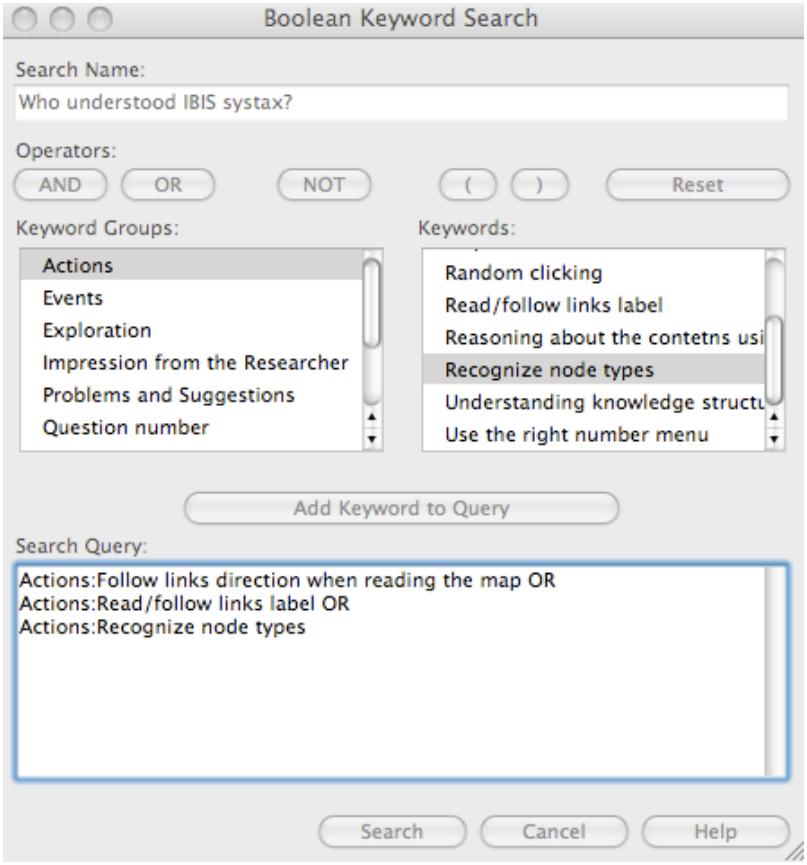

Figure 10-5: Identifying Participants that Understood IBIS Syntax by Using the Boolean Search Function in Transana

Analyzing the report we reckon that the most of the clips that show evidences of participants understanding IBIS are from Pc2 Pe, Pb. As we will se in the following, Pc2 and Pe proved to be the participants who gave the best overall performance, whereas Pa is the one who gave more detailed answers and who answered faster to Q7. Indeed Q7 is a question which strictly needs participants to understand the

meaning of the IBIS nodes and arrows in order to be accomplished. Thereby we can reckon that: data shows that people which better understood the IBIS structure gave a better performance both in the specific tasks requesting IBIS understanding and in the overall performance.

Pd failed completely this task, she explored all the discussion views but she was not able to reckon the IBIS icons and in particular the CON icons. Thereby after reading all the discussion she gave up, simply telling that she was unable to find any conflict

Pe: The first thing Pe did was opening the view of summary and looking for a category called conflicts, but she did not find it. Thereby she opened the discussion views and started reading. When the tutor asked them what she was doing she answered: "*well, honestly I am looking for the RED links, well… the thing is that I read the label "it oppose to" on this red link, so I understood that I had to look for this red links. This way it is immediately evident where conflicts are. After the links I also noticed the icons as well… but I think that the links labels are more intuitive*". In addition she opened all the discussion and identified all the conflicts. She also describes very precisely the matters of disagreements. We can definitely conclude that also in this case Pe mastered the tool and accomplished the task stressing all system features and following the experimentation logic.

Q8: Which is the geographical area of interest for the project?

Q9: Can you identify the main spatial problems in the neighbourhood? Can you identify them geographically?

These two questions aims at testing the effectiveness of the Spatial view for: i. locating the project geographically; ii. organizing and representing spatial arguments.

The hypothesis we make is that: in order to answer this questions the users should recognize, open and read the spatial view. In this case the exploration path is very easy (home view>spatial view), thus the user should be able to open the spatial view directly form the home list. The difficulty concerns the reading of spatial argument as represented in the view.

Pa: Pa has no problem in opening the spatial view form the home list but in order to answer to the first question she resorts to the view of general information about SPPmem project. The Spatial view seems to be inappropriate to locate the project in a wider geographical framework. Geographical information about the wider geographic are in which San Pietro Piturno neighbourhood is located is missing. Furthermore Pa has no problem to read spatial arguments, thereby she interprets correctly the spatial view and she answers question 9 in a complete manner.

Pb: Pb has no problem to follow he exploration path Home view>spatial view but she doesn't look satisfied form the quality of the geographical information included in the system. Being a Planner she is concerned with problems of locating the geographical area of interest at wider geographical scale. She claims to be able to the municipality to which SPP neighbourhood pertains, but a wider geographical framework is missing to understand the links with the neighbour municipalities. This is not a problem of knowledge and information structure, because in this case the information is simply not included. This request/complain was moved from more then one participant, either at this stage of the experimentation or when answering the open-ended question about 'what you did not like or you would

enhance in the process memory system'. About what concern Q8 and Q9 we can then conclude that Pb successfully accomplished the tasks following the experimentation logic. She gave a low rate to Q8 because of the quality of the geographical data (r=3). On the contrary she liked the way in which spatial arguments were represented, thereby she gave a high rate to Q9 (r=5).

Pc1 and Pc2 show to have no problem in opening in answering these questions they open directly the spatial view and identify spatial problems. They had nothing to say about the map. Pc1 pointed out that it could have been more detailed (i.e. showing road names to specify and locate better the area of interest)

Pd and Pe both followed the experimentation logic and successfully answered Q8 and Q9. Even though both of them expressed some remarks about the need to enlarge the geographical scale (as already suggested form Pb). Pe in particular claimed: "*…but what do you mean for 'geographical area'?...if you mean SPP neighbourhood I can guess it easily… but if you ask me where SPP is, I cannot answer this question because there is not a larger scale location of the project area!*". On the contrary both Pd and Pe did not encounter any difficulty in locating the geographical view and exploring spatial argumentation within the view.

10.3.5 Usability and system features

The last part of the experimentation consisted of a post session questionnaire that aimed at checking:

- how deep participants understood the system aims and features (Q10,Q11)
- their attitude and opinions about system: what they liked, what they did nutlike (Q16, Q17)
- some usability issues: what problems they encountered in navigating the system and what suggestions they can give to improve it. (Q12, Q18)

W organized questionnaire answers in three categories: 1) perceived system objectives and features (Q10, Q11); 2) perceived usefulness (Q16, Q17); 3) perceived easy of use (Q12, Q18).

Perceived system objectives and features

Q10: Can you list main objectives of the system?

In order to answer this question Pa just copied and pasted information form the general view which describes the SPPmem project. She write in the questionnaire: "*the System is designed to assist ISF and the planning teams that were working on the requalification plan, to capture, map and visualize both technical information about the project and options, questions and arguments emerged during the planning process*".

Pb on the contrary gave a relevant and particularly interesting answer to this question. Also, it is evident from the character and vocabulary used to argument the answer that Pb is a Planning Practitioner.

In her opinion main objective of the system are (in quotes):

"*Tracing and making transparent the deliberation process behind decisions. In SPP case study the system aims to give reasons to bottom-up decisions, in order to make then easier the implementation of those decision within the community. In the second case of Campi Salentina (CS) the system*

aims to show the argumentation and reasons that brought to the selection of certain design solutions."

The two participants to the firs in-pair experimentation (Pc1) acknowledge as main objectives of the tool:

- showing how discussions evolves along time and space and
- showing how actors intervene in each discussion.

P3 and P4 are the two members of the second in-pair experimentation Pc2. Here below we report some quotes from the discussion they had before to answer Q10.

P3: " *In my opinion this tool is useful to give order to all the proposals and ideas given from the community to face the neighbourhood problems.*"

P4: "*Yes and also…to focalize the attention on 'relevant' questions…in fact many of the information and knowledge get lost if nobody points point the attention on them*"

P3: "*True and moreover it focalize the attention on specific problems and solutions visualizing in a map…in this it is easier both consulting information and localizing problems geographically".*

There by we can conclude that Pc2 lists as main objectives of the tool:

- Ordering results of consultation contents focusing on relevant issues that would be lost otherwise.
- Making easier the consultation of information about the deliberation process and the localization of problems geographically

Pd recognized as main objectives of the system: supporting the planning team to map and visualize information and arguments raised during the consultation meetings.

Pe claims that the system objective is to gather, organize and rationalize the information emerged by the participatory process. Moreover it aims at optimizing the system consultation and retrieving of information.

Q11: Can you list main features of the system?

Pa acknowledges as system main qualities:

1) the capability to map discussions and to represent them geographically.

2) The capability to monitor the contributions of a single author and to frame his way of reasoning along the whole process.

Pa claims that the Actors view allows to isolate one actor's contribution from the rest of the discussion and to monitor the actor performances along the process (claims, attitudes to problems, attitudes to people, way of reasoning etc). She recognizes these as new and very useful features to conduct on-going and post-hoc process analysis. I.e. she says:

"*The thing is that I could notice that the Mayor was monotonic in his interventions…he was just defending the municipality…and that Actor 1 is very problematic while Actor 4 has always been collaborative...this is very useful… for example and I could also post-hoc evaluate if the proposals coming from a specific group have been accepted in the final design solutions or not…* "

She interpreted content as strictly tied to the discussion context, while on the other hand she noticed that it is not possible to find and follow project decisions and their rationale.

Pb claims that: " *the system allow to explore contents according to several levels of in-depth examination. It is structured in several views. It looks interesting the discussion reconstruction and possibility to easily identify pro and con of different arguments in play. Nonetheless it is often difficult to follow the flow of discussion if the reconstruction is not properly done: i.e. paying attention that the arrow direction is only one and avoiding two sides arrows in the same map. Also it looks to be very useful the information associated to the node like (tags and right number pop-up menu), because this info allow to have a constant control on compendious information about the node while exploring the views*".

The couple Pc1, given the understanding of the objectives of the system that they pointed out in the previous answer, underlined as system features:

- The capability to show how actors contribute to the discussions with specific proposals or issues;
- The capability to locate and visualize on a map the issues.

In the following we report some key quotes that motivate their understanding of the system features.

P3: "*In my opinion the main function of the system is to extract knowledge from discussions…and to draw some direction to face design problems*"

P4: " *I think that for the community the function of a tool like this is to support the awareness of the neighbourhood problems*"

P3: " *I think that for the community the function is to engage with neighbourhood problems! This tool can be a mean to engage them and push them to participate."*

P3: *"… on the other hand I think it is a mean to gain consensus…in which way? Well trying to mach community willing. If I am a politician and I know the citizens needs I can eventually comes out with a proposal coherent with those needs just to gain consensus, and then I leave the proposal un-realized…" P3: "well this is a negative use of the tool…we can say that someone can use it to incline proposals toward the community needs…*"

Pd identifies as main features of the system: the thing that every element of the system is a node and every node can be represented in several views. This is a simple but clear definition of the main visualization means of the system.

Pe identified four main features of the system:

- Tracking and transcribing deliberation contents
- Linking actors to the statements they raised
- Organizing information on the base of their character (conceptual, social, spatial, temporal and project-oriented view)
- Mapping knowledge, by organizing a graphical summary of gathered information.

Perceived ease of use

Q12: List the main difficulties you encountered in navigating and querying the system

Q18: How could the project representation be improved? (Do you imagine a different/better way to represent information?)

Pa: Pa considers that in the system there are too many ways to reach the same information. And this gives her a sense of disorientation. Another problem she encountered is the representation of statements in different forms: somewhere they are represented as nodes in a graph-like structure, somewhere else as row in a list.

She finds that these two problems make difficult for the user to feel confident with the system because he doesn't follow repetitive path in the exploration, thus he doesn't memorize them. On the contrary he knows there are several ways to reach the same information, and different ways in which information can be represented.

Pb says that the main problems she encountered were the identification of the view of summary of the stories told form the participants. Pb things that "*these to things, stories from the citizens and summary of the claims, are particularly important at the beginning of the exploration in order to understand and contextualize the experience that have been structured and represented in the system. It is immensely useful to have always available an up-to-date summary of the process trough which it is then possible to access all project details*". Thereby Pb suggests that this information should be made more immediately evident and accessible when exploring the system.

Pc1 notice as main difficulties the visual impact with the new tool and with the use of the IBIS icon. In order to overcome this impact they suggest a few changes to improve the representation like: i.changing background colours, ii.supporting the icons understanding using an icon legend at the bottom of each view, iii.eliminating the stakeholder bar in the discussions view in order to leave more space for the discussions graphs.

Pd did not encounter any particular difficulties when exploring the system, she just suggests providing a better detailed geographical map as a base for the spatial argumentation.

Pe encountered difficulty to use the menu that pop-up when pointing the cursor at the right down number of a node; she almost did not use it at all.

Pe says: "*It is not easy to understand you can click on the different view clicking on the list of words that appears in the yellow box. This can be because I have the habits with the other systems I use normally, that the pop-up window is not something you can click on top; it is just a label, a flat info. So I have the habit to think this is the only think this window can give*".

She figured out that one possible reason for this could be that these pop-up windows are usually not menus. This implies that you do not expect to have the possibility to click and explore information that is in a windows popping-up and down as soon as you move the cursor. Thereby it is difficult for the users to discover this functionality.

Moreover about the general contents of the process memory she did nutlike not having a preliminary outline of the planning project at stake. As already remarked from Pb this initial information helps users to better contextualize information they are going to explore in the system. Pe is also an ISF member, thereby she envisioned possible uses of the tool in the organization. She would use it for tracking participatory process with the local community (like in SPP), and also for the inter-organizational ISF meetings that the organization conduct regularly in order to exchange information and knowledge between ISF members, to update them about projects going on in parallel, to discuss and define new goals long/short

term goal for the organization etc. In other terms Pe is thinking about a tool like this as an internal knowledge management system for the ISF organization.

Perceived usefulness

Q16: What did you like about this TOOL? (Can you list some advantages you see in using a system like this?)

Pa: Pa definitely liked the Actors' view and the Synthetic view. She considers the view of synthesis particularly important because this give a summary of the process while leaving open the possibility to enter in the process details (moving to the discussions' view, temporal view and spatial view). She says:

"…and then this last view is for sure very useful to make a summary. That is to say, if I want to know what proposals have been made I go to the proposals' list and I find them all…and then I can investigate in which phases of the process the proposals have been made…if before or after key events…and then …if I click here…I can see how the proposals fit in the specific discussions…so I think this is very interesting…"

Pb underlined several advantages of the use of the tool:

"*Firstly the tool allows not loosing the traceability of the knowledge evolution that brought to certain design decisions. It also allows the users to explore the deliberation contents focusing on different details and contexts, basing on their specific interests and roles. It also allows to reconstruct the cognitive paths of one experience, so that these can be re-used in other experiences of the same nature (i.e. re-using knowledge gathered during consultation meetings in more technical discussions about bigger scale master plans etc. Also, if you have an open-decision making system this tool can help to communicate to the new actors joining the process the evolution and history of the process itself. This way they can more easily and faster become active participants of the process.*"

The first in-pair experimentation couple Pc1 describe as main advantages: i.the possibility to have a straight and constant reference/link to the actors' identity, ii.the possibility (ones you understand their meaning) to follow IBIS icons to navigate faster into the discussion looking for the information you are seeking, the possibility to visualize maps; iv. The possibility to add references to regulation extracts, maps, previous planning reports and project data, that is to say to use the tool as project database ("*reducing the paper materials and artefact you need to carry on with you*!").

Pc2 discussed as main advantages of the system four features:

- easy and fast retrieving of information organized by categories and contexts
- geographical interface for locating the statements, this can help participant to be more detailed and explicit in their claims about spatial problems or on exploring the spatial impacts of their claims.
- support in making decision easier to understand and hopefully more consensual
- help making design solutions more legitimate by disclosing the design rationale (the logic and reasons behind design decisions) and in particular anchoring the solutions to the knowledge sources (both technical and non-technical, formal and informal knowledge) that have been used to select them.

Surprisingly this couple and in particular P3 was the only participant pointing out spontaneously the matter of legitimacy of design decisions. He claimed that the system offer a good way to help Planners to better make sense of their design rationale while they are electing design solutions and afterword to explain and disclose the reasons behind design decisions. In particular P3 says:

"*Designer as any other should be always been guided forms a kind of logic. Of course there is always a gap, an arbitrary choice that is expression of a creative act by the designer. But with a tool like this it should be easier to underline the logic of the solution… or at least to link this solution to the knowledge and information sources that the designer used and interpreted to build that solution. In this sense I think that…yes legitimacy...it legitimates the design choices by building connections between knowledge and information that have been used to make the design decision and the decision itself. I think this is a very good support for a planners!*"

P3: "*I think I would use the tool exactly how it has been used…not just to find consensus…like i.e. picking up two or three needs expressed from the community just to legitimate my arbitrary choices…but rather to explain the design solutions to the community and at the same time to make the community participate to the design decision*."

Pd indentified as main advantage of the tool the possibility to reconstruct the dynamic treat and the project history. Moreover she discussed the major advantages offered by the tool if used to make final evaluation about project performances and to represent the building process of social actions and project synergies.

Pe appreciated the " *contents are rationally organized in the system and the data are rapidly and easily consultable*". She believe that "*being able to trace a process of information and knowledge construction with a tool like this can help to make faster information exploration and also to allow a deeper analysis*."

Q17: What did you dislike about this tool? (Can you list some limits and disadvantages in the use of a system like this?)

Pa did not appreciate that there are too many ways in the system to reach the same information (see Pa's answer to Q12). Pa thinks that some improvement can be useful in the representation of discussions. She suggests to better represent link labels and then to better put in evidence CON nodes and Project Proposals.

Pb disliked some of the paths to reach nested information. In example she found difficult to use the right click menu and on the contrary she found extremely helpful the "view of summary".

While Pc1 suggested to better underline the themes of discussions, and to better represent discussion putting in evidence the starting question. This would help to have a guide, a starting point, to read the map.

Pc2 underlined as main limit of the tool the fact to be discretionary and arbitrary in tagging, structuring and representing information and knowledge. At the same time P4 recognize that the possibility to replay the videos is a fundamental help to mitigate this problem.

Pd describes as an important limitation to the tool potential the fact that he has been used after the end of the project. Pd was unsatisfied form the quality of the represented information, which she found to be partials and not enough detailed.

The main reason for that is that the system was not used and updated during the on going phase of the process. Thereby much information was lost and impossible to rebuild post-hoc. Pd then suggests that the system should be used and updated when the process is going on and directly from the people involved in the process.

Pe did not have any major remark about the system; she just would have like a more strict graphical order (bigger distance between nodes, higher symmetry in graphs especially in the maps representing the discussions, lighter colours etc). As a major risk for the tool she reckon that the system could push users to read the contents univocally, and mislead from discovering new meaning and interpretation of the information. As already remarked form Pc2 arbitrariness is one of the risk that the tool could run. This is actually one of the major issues of giving any kind of structure to information. There is a trade off between what you gain in terms of clarity, effectiveness of communication, easy information exploration and retrieving on one side and framing contents and intentionally/unintentionally forcing interpretation in certain direction and/or narrowing multiple understanding of the same facts.

10.4 Semi Structured Interviews

Two semi-structured interviews have been driven to domain expert in the field of policy/administration and decision-making theory. Before the interviews a demo of the three tools of the memory platform have been shown to the experts. In particular results of the SPP, MK and CS case studied have been presented and described. The main aim of the interviews was to gather a first feeling and reaction to the tools and to gather suggestion in how the tolls could be used in the two domains of expertise (policy/administration and decision-making). The interviews have been reported in the following by quoting the authors. Furthermore in last sub-section main findings are discussed.

10.4.1 Interview to a Regional Institution Representative

Can you judge the quality of the planning process representation? What do you think is useful for your domain of expertise?

“According to me both quality and modality of representation vary from case to case, (that is to say from memory building method to another) in some of the cases there is also a spatial representation together with the dialogues representation, while in other cases there is not. Thereby it is difficult to give a general judgment of the tools because they have been applied in different processes and with different way to represent the deliberative context. I think that the features and potential of the tools have been differently stressed in the different cases according to the different processes. In some cases in which the spatial information was relevant it has been considered, as also the temporal dimension. In other cases like in the MK experimentation in which it was a one-day meeting experimentation obviously the temporal and spatial dimension couldn't be taken in consideration.”

“In general term I could say that especially thinking about SPP case in which all the different tools and features have been applied I think it can be useful, ...very useful...Why? Because of the possibility to look at the themes and issues emerged during the participatory process under different perspectives, and to re-use

gathered information and knowledge also in the following phases of the planning process. This is very important because very often the only perspective that planners follow is the one that has been captured taking notes during the meetings or replaying the video of the meetings...and on the contrary having this different perspectives, especially the spatial and temporal, is very useful to enrich the knowledge we usually are able to gather from these processes."

What do you think is imprecise or improvable? What is missing to make the representation effective?

"What I think can be improved... In my opinion one of the key point is that every dimension of the process memory: social, spatial, temporal...is reconstructed from the observer-participant, the knowledge manager, who obviously provides a personal interpretation that is exactly what interconnect information in the system. Which is anyway useful, but if this could be also entrusted to the participants this could probably push participants to go back and reflect on their interaction, on the logical links made about facts and information, and they could "probably" also learn better and more from the participatory process. What is missing to obtain an effective representation of these processes? There is not something missing. Well, it is normal that like in all representation there is something missing ...that I think is the dynamic of a real process. In this case the process is segmented and fragmented in information chunks and it is rebuilt and reconnected afterword. By doing this, the multidimensionality and multi-sensorial experience that is proper of the real life processes is lost. So I would rather say that what is in addition to the participatory process itself, is the mediation of who is reconstructing the environment. What I would try to improve is the quality of the representation of the processes by showing the project to the participants for evaluation. I think this could help to make the representation better."

What are the critical moments of a participatory process that should not be lost and are worth to be preserved in the history of a participatory planning process?

"If we talk about participatory design we shouldn't louse the moments in which the creativity of the actors and the interaction between them develops. Because usually those are the moment in which new knowledge and ideas are generated and…. honestly I should say that this tools from this point of view can be very useful because designers can use the tool to analyze, inquiry, explore, connect and then go much deeper in the process after the meeting. They can reflect on words and events they did not catch or that slipped their mind during the process. So hopefully they can go back to some of the key points, revise them and even present them again in other meetings to be discussed with the design group. This can be a first direct advantage of using the memory platform as a mean to reflect and act during the process. There is much information we loose in the interaction so the memory platform can be very useful in this sense. But if these are the critical moments that need to be supported the video material needs to be valued and also annotated with critical reflection on the exploration of the video itself (i.e. things I was unable to catch and that I eventually caught watching the video replay). I could also decide to book another meeting with the team to discuss about the new insights gathered during the re-exploration of the process and of the process memory contents."

Are the 5 dimensions (social, spatial, temporal, geographical and argumentative) comprehensive for the planning process representation?

"A serious problem is that participants are not able to deal with technical drawings. So what I would like to see to improve the system is to view the spaces with representation of virtual reality (3D representation etc) so that it can be easier for them to visualize and recognize the spaces they are used to live in. This would help a lot to enhance the representation. The more I work in this field the more I convince myself that we cannot imagine to have participatory processes about plan drawing pretending that participant can be active and able to act on real decision (design decision) if we do not start to give different representation of the reality which goes beyond the 2D dimension. People are not able to reason in 2D dimension, and they have huge problems to orient their self also in spaces extremely confined. That's because real perception of reality is completely different from 2D maps. 'Planning for real' as a research field is born as an approach to participatory planning that use models in order to make people express their selves as in real life settings. In this sense 2D cartography is a step backward. A part that, the 5 dimension looks to be quite comprehensives."

Which other dimension could be added?

"I am wondering if participants can be represented ignoring their personal story, it would be nice having their biographies. I can see them with the picture, but who they are, the fact that an actor is also a designer could be relevant...probably the role of the actors should be better represented and underlined. I have the impression that the conceptual model that is behind this participatory process representation does not aims to design and influence the participatory process but just tries to rebuilt the knowledge heritage generated during the participatory process. This is a bias that is in the approach itself."

"In my opinion the representation does not put enough in evidence the power roles stakeholders have. The power hierarchies that exist and that are very relevant for the process are not effectively represented. I am wondering if and, I am proposing that, this tool can help to unhide this dimensions of asymmetries of power."

"Also, I think it could be also misleading for the process representation having a flat image of the planning process that is very far away from the real one. Thereby I think that the dimension of the roles could be made better, more evident and clear in the representation".

How this system could be used in a public administration?

"We are now defining in the regional administration office, the instrument of "conference of services" that is defined as the planning instrument for developing co-planning at regional level. Co-planning is referred to as the practice of collaboration and coordination of planning activities at different administrative and geographical scales. In this environment a tool like this would be very useful both to record the meetings and also to track the plan descriptions and presentations given from the planning team to the representative of the invited institution during those meetings. On this basis a discussion is developed about the plan itself. Different administration and different expertise interact and discuss about the raised issues, thereby a tool like this would be very useful. Especially because this "co-planning

conferences", unlike normal participatory planning and consultation meetings (in which you can have a lot of meetings and an unknown number of participants), take place in an institutional environment, have a limited number of invited participant, and the number of the meeting is less and defined by law (one or two meetings maximum per procedure).

"Moreover a tool like this could be useful to reconstruct and analyze what happened form one conference to the other. Usually between the first and the second conference participants, representatives of the different institution, needs to know not only what have been said in the previous conference but also to make sense of what happened in the meanwhile in order to be prepared to contribute to the following part of the planning process."

"It would be nice to see how to automatically generate a multimedia report of the institutional meetings. I.e. In the written report of co-planning meetings we usually write: "the assembly agreed that the park xy needs to be better protected in this ways etc." having a report that give also a geographical dimension etc can be very useful."

"At regional level the institution could use a system like this to track and support the moments of interaction with several institutions, like in the co-planning conferences. Moreover if every municipality used the same tools in their meetings it would be of enormous value for the regional institution because they would have activities report built with the same structure and then easy to integrate at regional activity level. So this would be a very good material to use in those inter-institutional debates."

Which obstacles can you imagine to the use of these tools, form the political and administrative classes?

"I see al always positive a completely transparent tracing of design decisions! I think this is not an obstacle but an added value that is invaluable if we are trying to push the municipality to enlarge the sphere of public participation to the planning process. Because since the plan will remain a technical prerogative of planners, political representatives and group of interests (enterprises etc) the plan will be always prone to the principles of increasing the real estate values. While if you want a plan which focuses on cultural, environmental, education, leisure heritage issues, you need to involve and engage the communities. The only arenas in which those issues are discussed are public meetings with the representative of local associations, and those arenas need to be listened or it is difficult to reach this information. Thereby transparency is very important."

"Now…if we talk about the political and administrative class, I have to admit that those environments are very resistant to change. It could be really difficult to introduce any kind of innovation in the administrative process. There is a cultural resistance to innovation. On the other end, politicians see like dangerous everything that could fret or undermine the spaces and procedure in which unilateral decision develops. The status quo is always defended from the political class against anything that could undermine its decisional power. Thereby these tools can be seen as hostiles, because they do not support unidirectional flow of knowledge, they show knowledge coming from different expertise and because they support interactive sharing and exchanging of information.

"But of course it depends from the political class, if the objective of the political class is to open up the planning process to community participation, the reaction to these tools shouldn't be so negative."

"Moreover, we have to remember that institutional meetings in which decisions are taken are video recorded by law. Legislation imposes that all municipal meetings are video recorded, and transcripts of the conversations are generated. Thereby a tool like this would be just a way to better organize and explore meeting contents. One risk on the contrary could be self-representation. Politician could use those tools as means to celebrate their self; while on the contrary technician could decide to censure their claims in order not to make overstatements they are not completely sure about. The risk is to loose the spontaneity and directness of people behaviours. Every time a technical mean is put in the middle of a natural process this could unavoidably affect the process itself."

10.4.2 Interview to a Decision Theory Expert

Can you discuss how good/bad the system represent deliberation? What is missing in the representation? How can the management of deliberation contents be improved?

"I think the tools can provide a very rich representation of the deliberation process. But I think that in order to improve the managements of deliberation contents these tools should be coupled with a method...the decision-making process should follow certain methods in order to benefit of the use of these tools…. I.e.: population, experts, community…what are they looking for? How the system can support them? How can navigate the system to reach their objectives?"

"In my opinion the memory system you presented follows a categorization of information that gives rich data about the deliberation process…and these data can be analyzed and manipulate in many different way to support the decision-making process. But you need to couple the system with some methods that support the different users in using it…. In example thinking about my domain of expertise, in collaborative decision making field in the business domain I can see the system very useful if it can be coupled with better reporting capability. Good reporting capability can help to easily prepare summary of meetings, and ad-hoc analysis i.e. list all the decision taken, list all the disagreements, conflicts ordered by time or area of interest etc"

"I think that so far you worked with raw data, like geographical data, statements raised in the discussions…now on top of this you can build systems, like ontology-based systems, in example that can support complex queries about the deliberation process and that can help decision makers to reason with the huge amount of row information and data you collected."

Which are the critical elements for decision-making? Are or could these elements be represented with a system like this?

"The critical issues for decision making are: defining what is the problem; what are the objectives; and looking for alternatives…the tools can offer a rich representation of those issues but …again…in my opinion in order to effectively support decision-making I need to be provided with specific methods through which I can take advantage of these rich representations.

Given your understanding of decision-making domain, can this system be used to support decision-making? And how?

I think that these tools can support decision-making but you need to make very clear what is the agenda. That is to say you need to specify that: the method we will go to the meeting with is this one...and the model of the meetings is this…. and the model of the tool is this…and we will use the tools in this way, with this model of the meetings. In other words I think that these tools can be useful just if you model your decision-making process in an adequate manner in order to take advantage of the tools application.

Do you see any major problem to the use of a system like this in your domain?

"I think that these tools are first of all tools to allow a very deep analysis of the deliberation process. Of course this can help decision-makers in better understanding the decision-making process, but on the other hand I can see ethical problems...If everything is recorded, who really is the owner of those information? Who has access to it? Who can open the contents and explore them? Imagine all these rich information's indexed by person are published in interned and the holding like Google start using these info to enrich my profile, and make them accessible to everybody…I could not like other people to know in detail what I said or did… I think that the system make too easy the analysis of personal information about the stakeholders, and this can be a major problem in the business field…so, I think that to avoid this it is necessary to disassociate issues from people."

10.4.3 Discussing Expert Interviews Results

This two semi structured interview suggested new ways to look at the design and implementation of a memory system supporting collaborative design and deliberation.

From the first interview we first of all got an enthusiastic reaction about using the tool in the planning field. The interviewee, that is a planning practitioner and responsible for the regional planning institution, states about the system:

"*I think it can be useful, ...very useful...Why? Because of the possibility to look at the themes and issues emerged during the participatory process under different perspectives, and to re-use gathered information and knowledge also in the following phases of the planning process…having this different perspectives, especially the spatial and temporal, is very useful to enrich the knowledge we usually are able to gather from these processes*."

The interviewee appreciates the multiple-context representation of information which offers multiple perspectives on the process. This way the system allows enriching the knowledge base gathered and used during participatory planning processes.

The interviewee says that the main advantage of the tool can be to trace the participatory moments in which the creativity of the actors and their interaction develops, that are the moment in which new knowledge and ideas are created within the group. She claims that: "*designers can use the tool to analyze, inquiry, explore, connect and then go much deeper in the process after the meeting. They can reflect on words and events they did not catch or that slipped their mind during the process. So hopefully they can go back to some of the key points, revise them and even present them again in other meetings to be discussed*

with the design group. This can be a first direct advantage of using the memory platform as a mean to reflect and act during the process. There is much information we loose in the interaction so the memory platform can be very useful in this sense."

The interviewee suggests that the memory platform should be used first of all as a mean to "*reflect and act during the process*". In line with this interpretation of the tools she propose to involve the stakeholders in building, other then exploring, the memory system. This way the memory platform can support stakeholders in this process of reflection in action that go together with the planning process and with the memory building activities.

At the same time she identified two issues: the problem of interpretation, and the problem of the lost of multi-sensorial experiences proper of real life setting.

Concerning the first issue she discuss the opportunity to involve participants (planners, citizens, politicians etc) in building together the history of the process of structuring the information. She believes that "*this could probably push participants to go back to their, interaction, logical links made about facts and information, and they could "probably" also learn better and more from the participatory process*". Involving stakeholders in the knowledge structuring and representation can reduce the risk of misinterpretation and/or manipulation form the knowledge manager and, at the same time, it can build new occasions for the participants to reflects on the planning process and to understand better issues, opportunities and arguments and counterarguments in play.

Concerning the second issue she suggests to improve the system by adding 3D representations and virtual reality tools to support participant to perform spatial reasoning. She claims that "*we cannot imagine to have participatory processes about plan drawing pretending that participant can be active and able to act on real decision (design decision) if we do not start to give different representation of the reality which goes beyond the 2D dimension. People are not able to reason in 2D dimension, and they have huge problems to orient their self also in spaces extremely confined. That's because real perception of reality is completely different from 2D maps*!"

Moreover she suggests putting more in evidence in the system the power roles and asymmetry of power that characterize the planning process. In particular she suggests making clearer and evident in the system the organizational and institutional roles that the different stakeholders plays. This can help to avoid misleading interpretation of a 'flat' participatory planning process in which all stakeholders have and play equal roles, that is far to be a real condition in whatever planning practice.

Surprisingly this suggestion opposes to the one given from the second interviewee (the expert of negotiation and decision-making theory). According to him the association of issues to people can open major problems about privacy issues, thereby he suggested disassociating these information. In fact in a pure collaborative decision-making environments the only thing that should matter are the concepts and issues, despite who made it. Many negotiation processes happen in anonymity, and with democratic voting of alternatives in order to avoid that that power gain can influence the group decision. These environments are very different form modern planning arenas, in which power relationships have proved to be key in the development and dynamics of the planning process. Thereby it is not

possible to reach any realistic understanding of the planning process without considering these dynamic in play.

Nonetheless concerns about privacy problems need to be considered especially in terms of what can be disclosed to a wider community. The integration between Compendium and CoPe_it! and the consequent diffusion of personal information on the web is a key issue addressed to specific fields of study in the e-Participatory domain. Thereby these concerns need to be considered in the very moment in which any of that information wants to be published.

About the use of the system in public administrations and local institution the first interviewee suggests to use the platform to trace inter-institutional meetings and co-planning conferences. These are institutionalized moment of interaction between different local authorities on common and transversal issues. She suggests these meetings because they are hosted in institutionalized environments that are much easier to control. Number of meetings is limited and participants are known. In this way it is easer to organize the deliberation tracking activities with the different tools of the platform. Moreover these meetings are video recorded and transcribed by law; thereby there are no problem of ownership of information and privacy issues to face.

As we will discuss in the next chapter probably a process memory platform should be designed with different levels of accessibility to data and permissions for different users types in order to consider privacy issues.

Surprisingly it looks like institutionalized environments are the more appropriate to test and use these tools even if these are also considered hostile environment to innovation and change. As uttered form the first interviewee:" *…if we talk about political and administrative class, I have to admit that those environments are very resistant to change. It could be really difficult to introduce any kind of innovation in the administrative process. There is a cultural resistance to innovation. On the other hand, politicians consider dangerous everything that could fret or undermine unilateral decision. The status quo is always defended from the political class against anything that could undermine the current decisional power.*"

It comes out clearly the fact that a cultural change and a better attitude toward citizen inclusion and participation to planning and policy decisions need to take place before that any of these tools and methodology can exert any real influence on planning practices. Nonetheless pilot projects and real case studies testing can be the starting points for this cultural change to happen at administration and policy level. But even before this, a change in the culture of planning is needed. Planners the first needs to abandon preconceptions about participatory planning practice. On this concern, new technologies can give novel opportunities and open new perspectives to participation, thus augmenting effectiveness and impact that these practices can exercise.

Looking at the planning side, the second interviewee suggests that a good reporting capability could be very helpful. The first interviewee suggests providing the tool with an automatically generated multimedia report of the institutional meetings. The second interviewee enlarge the concept of good reporting capability with the need for ad-hoc report automatically generate in response to personalized and ad-hoc system queries: i.e. report of all decision taken in a specified time period. I.e.:

report of all the questions raised form the institutional representatives, report of all the needs expressed from the community etc.

The second interviewee appreciates the categorization of deliberation contents and the use of the memory platform tools to allow deep analysis of the deliberation process. He reckons that these features can help decision-makers in better understanding the decision-making process, but he suggests two major improvements to the tools.

The first improvement consists of coupling the tool with a clear methodology of application, use and exploration. Different users like politicians, community members, planners etc need to know exactly what they can get from the tools, and how they should use them in order to maximize the benefits of using them. Therefore a clear agenda on meeting models, knowledge structure and methodology of application needs to be provided in order to 'persuade' planners and practitioners that the platform is worth to use.

On another hand the second interviewee suggests that in order to use the tools as real support to decision-making users should be provided with support complex querying and reasoning.

Ontology is a good opportunity to enhance the reach data structuring with supported data interpretation, reasoning and knowledge generation. The second interviewee claims:

"*I think that so far you worked with raw data, like geographical data, statements raised in the discussions…now on top of this you can build systems, like ontology-based systems, in example that can support complex queries about the deliberation process and that can help decision makers to reason with the huge amount of row information and data you collected.*"

While the system how it is a very good tools to support in-depth analysis of participatory processes and deliberation contents, the second interview suggests that a possible future line of research can be devoted to building ontology-based systems able to support reasoning and decision making in the participatory planning field.

10.5 Experimentation with a Class of Planning Students

An experimentation has been driven with a class of 20 undergraduate students attending the Urban Planning degree. The students have been involved in the exploration of the SPP memory system.

The 20 students have been involved in a one-hour exercise in which they had to collaboratively brows he hypertext in order to answer certain questions about SPP project. The objective is always in line with *Q1: Is it easy to identify and extract information and knowledge from the system?* In particular what we are interested is people reactions to the tool's potential. Thereby we focused this experimentation on asking for reactions to what they've seen, and any weaknesses, and the potential they see. Thereby we focused on the two sub questions: *Qc: Is the system easy to use and explore? Qe: What do people like dislike about the system?*

The experimentation has been organized with the help of a moderator engaged in using compendium and browsing the SPP application, but just following the actions the students told him. In this way we could monitor the process the class went through with compendium because they had to talk loudly to ask the moderator to do something.

The pro of this way of proceeding is that we avoided minor usability problems, allowing the class to focus more on the quality of information structure.

All the experimentation has been recorder with a video camera. Students have been asked to imagine to be members of a planning team in charge of making a summary of main results of a past consultation process driven a long time ago.

The main question the summary had to answer were:

- What are the main problems raised during the meetings?
- What are the main resources raised during the meetings?
- What are the possible ideas and/or project proposals raised during the meetings?
- What complains and needs have been raised during the meetings?

The moderator asked a volunteer to try and 'steer' him to the answer to each question and when they got stuck, then the moderator asked others to help. The moderator and the volunteer faced the class and were engaged with the computer application while a video projector showed the screen on the wall in order the other students to contribute to the experimentation (in Figure 10-6 the experimentation setting and two of the volunteers). All of them had the task to give these answers. The exercise finished when all students claimed they had explored the system enough in order to answered to the questionnaire. At the end of the exercise a quick questionnaire have been distributed to the class with open questions about the system and about his ability to retrieve info.

Figure 10-6: Experimentation with Planning Students

One of the students was in charge of taking notes for the class; he had to answer to the questions describing how the class went trough the answers.

Thereby at the end we got 20 questionnaires filled by each student after the experimentation, and one questionnaire for the whole class written by one of the students while the experimentation was going on and with the active help of the entire group.

In the final evaluation questionnaire we asked the students to rate the Ease of use of the tools in order to accomplish the different tasks.

The questions are reported in the table here below.

Table 10-3: Questionnaire

Q1	I can easily find information about the project.
Q2	I can easily identify stakeholders involved and their organizations.
Q3	I can easily identify the key actors and what they said
Q4	I can easily identify who raised more problem and who proposed more ideas
Q5	I can easily identify specific proposals done during the meetings
Q6	I can easily identify main problems raised during the meetings
Q7	I can easily identify conflicts and disagreements
Q8	It is easy to understand what's the geographical area of interest.
Q9	I can easily identify problems geographically

Participants had to give a rate form 1 to 5 where:

Table 10-4: Rates to associate to questions

RATES	Description
1 =	Absolutely not
2 =	No
3 =	Yes/No
4 =	Yes
5 =	Absolutely Yes

Moreover we gave them the following open-ended questions:

- q1: What did you like about the tool?
- q2: Which potential can you see?
- q3: Being a planning practitioner how would you use it?
- q4: What did you dislike about the tool?
- q5: Which limits can you see?
- q6: How would you improve it?

As we will see in the following section, the general rates the students gave to the easiness of the information extraction are quite high. Also they generally make positive claims and showed positive reactions about the tools. At the same time when analyzing the questionnaires we realized that the majority of the students declared they found the system quite difficult to explore. Words like: 'messy', 'dispersive', 'distracting' have been used to list what they did not like about the tool, sign that they encountered problems despite the high rates they gave to the questions easiness evaluation. The main difficulties they identified are the presence of too many information, too many keywords to remember, to many possible exploration paths to reach the same information. This problem was also underlined in the behavioural experimentation from Pa. Too many hyperlink and exploration path make more difficult for the users to 'learn' how to explore the system, to

memorize the exploration paths, thereby it is more difficult to answer quickly to the questions.

Some of the students pretend the system to be an effective system to support planners to give clear (and hopefully fast) answer to planning questions, more then a tool for sensemaking and reflection about planning issues and their deeps meaning and implication in the considered planning system.

This difference of expectation and approach to the system was clear in their answer to the open-ended question, and, not surprisingly, they found the system very disappointing.

Pp answers q4 in this way:

"*When we open an hyperlink we access a view full of other hyperlinks, and …this is discouraging for the exploration, and it make difficult to elaborate the answers to the questions. It a medieval mess! As my grandmother say: "the house with three doors is taken away from the devil!" …because the house become engulfed in confusion! Thereby answer to any kind of question by using this tool it is possible just going slowly, making your mind step by step of what you are reading and this just means relying on an inductive procedure!*"

According to Pq these are negative features of the tool because he is looking for a tool supporting the planner to give 'fast and good' answers to his question, and not a tool to support reflection and in depth analysis.

The experimentation gave evidence that the tool is not a tool to gives answers to planning issues. If conceived this way it is, and it has been evaluated, ineffective and even counterproductive; because it disorients the attention on many details and it disperses the exploration efforts. In fact information is spread in many interconnected paths and information loops which makes the process of exploration more then a querying/retrieving process. It is rather a process of understanding of contents and making-sense of them in relation to the question.

The questionnaire results mirror these two possible expectations and approaches to the system.

In the following we discuss results of the questionnaire dividing the answer in two categories Advantages/Potential (q1, q2, q3) and Limits/improvements (q4, q5, q6).

10.5.1 Advantages/Potential

Pf: The tool can provide a quick vision on problems and on participants so that you can understand what is going on.

Pg: I like the organization of the first view (home view) and the criteria with which the main topics are organized. This tool can be good in the preliminary phases of a planning project, especially for planner that are not from the local area of interest for the plan and that need to know all dynamics in play. Therefore I would use it to frame the main problematic setting and to get suggestions form the lay people.

Ph: I like the details I can gather on each stakeholder. I can observe how he contributed to the project trough his statements. I would use it to argument about the evolution of any kind of event that involves several stakeholders.

Pi: The system schematizes clearly information about the project and it has a user-friendly interface. It describes the project and the situations and discussions that have generated it.

Pj: I really liked the graphical interface that is ordered and thus makes the use easier. I liked the way the system guides the users throughout the discussion by questions. This can be a very useful aid, especially for planners to collect and order information on the community. I would use it in a preliminary phase of the planning process.

Pk: I appreciate the apparently direct connections between people that wouldn't have otherwise many occasions and ways to communicate (i.e. the major and the citizens). This can in one hand offer a new way to give voice to people that without these tools would not have one; and, on the other hand, this can help to identify and monitor which answers to people needs have been given and which measures have been really put in practice from the institutional agency (i.e. the major and the district council).

Pl: The tool allows summarizing and schematizing the contents of consultation meetings, thereby I think it is a good tool for planners in order to gather useful information for the design process.

Pm: I think that a tool like this can be very useful to verify to which extent the planning practice keeps or have kept in regard the real needs and demands moved from the local communities. This can also be a good way to verify how much dialogue and participation can be useful to the definition of the planning problem setting.

Pn: With this tool we can observe opinions and proposals from the all community, we can also focus on spatial problems to solve. I would use it in particular to facilitate comparison between people, and eventually to solve disagreements emerged during the meetings.

Po: It is possible to identify clearly and to analyze the opinions expressed by the actors involved in the process, focusing on proposals, needs, and on the answers given during the meetings. The system allows analyzing the problems in which the community opinion is extremely relevant in order to find a solution. In a certain way it is like if the community play the role of "planner". I would use the tool in order to identify and analyze those problems that are tightly connected with the community.

Pp: I cannot imagine any potential in this tool. A tool is powerful when it is easy to access and harmonically organized; and I do not think this tool has these characteristics.

Pq: I liked that with this tool you could summarize problems and proposals about the planning issues that have been discussed with the lay people. In this way the tool can help to identify problems and proposals that are agreed from the community and that thereby would not encounter any obstacle if and when implemented.

Pr: The tool allows understanding proposals and related answers about project proposals. By coupling the use of the tool with specific questions to submit to a wide number of actors it can be possible to reach a complete and specific framing of

community demands and needs on several subjects. I think this is mainly a tool of inquiry and as such I would use it to discuss with the community about design alternatives and possible problems solutions.

Ps: I like the system because it is easy to use, diagrams are clear, I can read details on single participants, their comments, and I can analyze contents of discussions. I think that this tool is very useful to have a deep understanding of the problem setting. In fact, it allows framing in details the problems, putting in relation all the actors of the process. It gives the possibility to hear the voices of diverse actors distinguishing who is talking to defend a private interests and who is behaving as spokesman of the general interest of the community, and between them it allows to distinguish between different judgments of values and priorities. I would use it in a preliminary planning phase to understand the local situation and to choose the direction that the planning activities will try to address. After that I would use it to evaluate the feasibility of the different ideas and suggestions in relation to the technical constraints (Administrative and planning norms, resources, schedule etc).

Pt: First of all I like the objective the tool. The big potential I see is the possibility to have an environment and a tool to investigate the right balance and combination between community needs and exploitation of local resources and potentials.

Pu: I like the Tool because it summarizes in a simple way all discussions in all details (proposals, needs, oppositions etc). Also I think it is well structured and easy to use. I see as bigger potential that it is a good tool to understand the problems, to understand the best solution to the problem and also to understand how to make this solution operational on the territory.

Pv: It is a tool to know and understand the problems of the community, and a good tool to explore possible solutions.

Pw: The potential I see is to use the tool to draw a plan that is compatible with the community interests and demands. I would use it to continuously revise and adjust to the community needs.

Py: The tool provides many different ways to understand the problem setting. Also it supports an easy elaboration of project proposals raised form the lay actors. I would use in the long-range time within the municipality in order to understand the problems that the different organizations and lay actors have. In this way local institutions can identify and try to solve the most recurring problems and demands. It is a good way to define priorities for the local communities. Then it is up to the local authorities to allocate appropriate resources to solve them.

10.5.2 Limits/Improvements

Pf: The tool is too disorienting and meaning of icon is not immediately clear. Probably an introduction on icons and links meaning could help enhancing system exploration performances.

Pg: At a first sight it is very well organized but then as soon as you go deep in the nested view the thick branches of links can disorient. I would also explain better the meaning of certain symbols.

Ph: The information schema is not so clear at the beginning thereby more time is needed to understand how the system works.

Pi: It would have been easier to explore the system if the views were less rich in text and richer in symbols and images. The main limit I can see is the growing of information complexity upon growing of project scale.

Pj: If the number of participants to the planning process augments, the graph of the discussions can become very confusing and messy, and this can be a major problem.

Pk: I think it is confusing and lacking of a clear illustration of 'key paths of exploration'. This implies that the user needs to proceed giving a try and then another one since he doesn't create his own paths of explorations. This can unnerve the user, especially if he is trying to accomplish some specific tasks. I would make the system simpler, i.e. by eliminating some of the hyper textual links that can be confusing.

Pm: I did not like the disorder of the icons and the repetition of the same information in more then one view.

Pn: The system doesn't tell you who were the key actors, and it is difficult to generalize problem and solutions to all geographic areas.

Po: The tool is slightly complex and difficult to explore, thereby it is difficult to imagine that non-expert users without the mediation of a guide or tutor can use it.

Pp: When we open an hyperlink we access a view full of other hyperlinks, and …this is discouraging for the exploration, and it make difficult to elaborate the answers to the questions. It a medieval mess! As my grandmother say: "*the house with three doors is taken away from the devil!*" …because the house become engulfed in confusion! Thereby answer to any kind of question by using this tool it is possible just going slowly, making your mind step by step of what you are reading and this just means relying on an inductive procedure!

Pq: It is not enough clear and it is confusing when you try to relate problems and proposals to the people who raised them. Moreover. The sample of involved participants can be not representative of the entire population thereby the gathered answers and statements of the community representatives can help to identify problems but cannot be enough to solve them. I also think that this tool can be of difficult application for planning at municipal or regional level because it is already confusing for small areas…imagine for larger scales. I would suggest to narrow the number of involved actors to the representatives of local institutions and organizations and to narrow the represented statements the relevant ones, which means the one that really help to set the problems and find solutions.

Pr: It should be easer to read and explore. Also it is shows very fragmented information, I would like to see in it some kind of summary which put all information together.

Ps: there is nothing I do not like. It is already great! Probably I would like a legend of the icon in every view, not just at the beginning.

Pt: I think it is too simplistic in the exposition of the problems and solutions. Moreover, I would improve the tool by adding a web forum to gather further suggestions, oppositions from people that for several reasons could not participate to the meetings.

Pv: I think that the tool is a bit confusing and disorienting. There are too many keywords to control in order to reach any conclusion. There are too many links and hyperlinks that impede to give a quick answer to the questions. Thereby it can be dispersive and it is easy that you leave the path that you wanted to follow and end up somewhere else. I think that the tool should be improved with a way to eliminate information that can be useless.

Pw: I think that the tool is addressing technical planners more then the enlarged population. I think it needs to use easier symbols and words in order to be explored from the entire population.

Px: It was quite difficult to identify the key actors, and also I think the tool is a bit dispersive, there are too many nested views and this make difficult to give quick answers. Moreover it looks like the tool is addressing expert planner more then the general community. Thereby I would try to make it easier to explore.

10.6 Statistical Analysis

We conclude our evaluation with a presentation of the observations extracted form the statistical analysis we performed both on the questionnaires and on the data about users' performances during the behavioural experimentation.

We distributed 26 questionnaires: 6 questionnaires have been completed from the participants of the behavioural experimentation. The other 20 have been distributed to the class of undergraduate students of the Urban Planning degree.

In the following table we report the results for the evaluation questionnaires. As we can see in one and a half hour exploration the class was able to answer just to four of the question. Indeed, the group experimentation went much slower compared with the single and in-pair experimentations. Thereby the questionnaires have complete results up to Q4.

Table 10-5: Participants' General info and Task Evaluation

Education	P. ref	Sex	Age	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
PhD, Researcher	Pa	F	44	1	5	4	5	5	5	3	4	5
PhD, Researcher	Pb	F	34	3	5	4	5	5	5	5	3	5
Undergraduate Student	Pc1	F/F	24/24	4	5	3	5	5	5	5	5	5
Undergraduate Student	Pc2	F/M	24/25	5	5	5	5	5	5	4	5	5
Undergraduate Student	Pd	F	34	5	5	4	5	5	5	1	5	5
Undergraduate Student	Pe	F	26	5	5	4	4	2	2	3	3	5
Undergraduate Student	Pf	M	23	4	4	3	3	/	/	/	/	/
Undergraduate Student	Pg	M	24	4	4	2	3	/	/	/	/	/
Undergraduate Student	Ph	M	25	3	5	5	4	5	5	5	/	/
Undergraduate Student	Pi	M	23	5	5	3	4	/	/	/	/	/
Undergraduate Student	Pj	M	22	5	5	4	3	/	/	/	/	/
Undergraduate Student	Pk	M	24	2	4	1	2	/	/	/	/	/
Undergraduate Student	Pl	M	25	5	5	5	3	4	4	5	2	1
Undergraduate Student	Pm	F	23	4	4	3	2	/	/	/	/	/
Undergraduate Student	Pn	F	25	4	3	3	2	/	/	/	/	/
Undergraduate Student	Po	F	22	4	3	3	2	/	/	/	/	/
Undergraduate Student	Pp	M	23	2	4	2	2	/	/	/	/	/
Undergraduate Student	Pq	M	23	5	4	3	2	/	/	/	/	/
Undergraduate Student	Pr	M	22	4	4	3	3	/	/	/	/	/
Undergraduate Student	Ps	M	22	5	4	4	4	/	/	/	/	/
Undergraduate Student	Pt	M	24	3	4	3	3	/	/	/	/	/
Undergraduate Student	Pu	M	22	5	5	3	3	/	/	/	/	/
Undergraduate Student	Pv	M	24	2	3	2	3	/	/	/	/	/
Undergraduate Student	Pw	F	23	4	3	2	4	/	/	/	/	/
Undergraduate Student	Px	F	23	4	4	3	4	/	/	/	/	/
Undergraduate Student	Py	M	23	3	4	2	3	4	3	/	/	/
AVERADGE				3.847	4.270	3.192	3.385	4.444	4.333	3.875	3.857	4.428

Most participants considered that the system is easy to explore and easy to use in order to accomplish the nine tasks. In fact, the average rates calculated on all participants for each questions shows rates ranging from 3 to 5 (from medium to absolutely easy), with a medium value around 3,96 (see Figure 10-7).

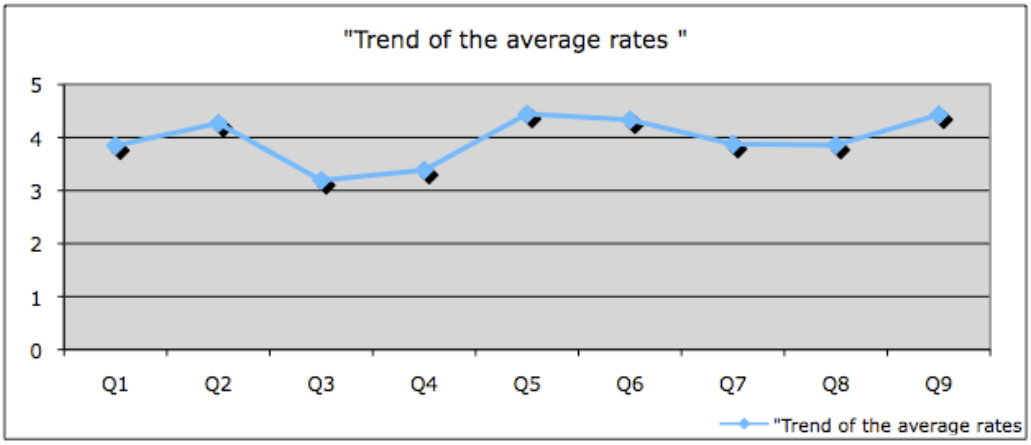

Figure 10-7: Trend of the Average Rates

The following chart shows results of the behavioural experimentation and in particular the trend of fulfilment of the nine tasks. A value 'one' on the vertical axe indicates that the participant answered successfully to the task following the experimentation logic. A value "zero" indicates a failure. As we discussed in section 10.3.2 value one implies that the system was easy to use and able to successfully support the users in their tasks

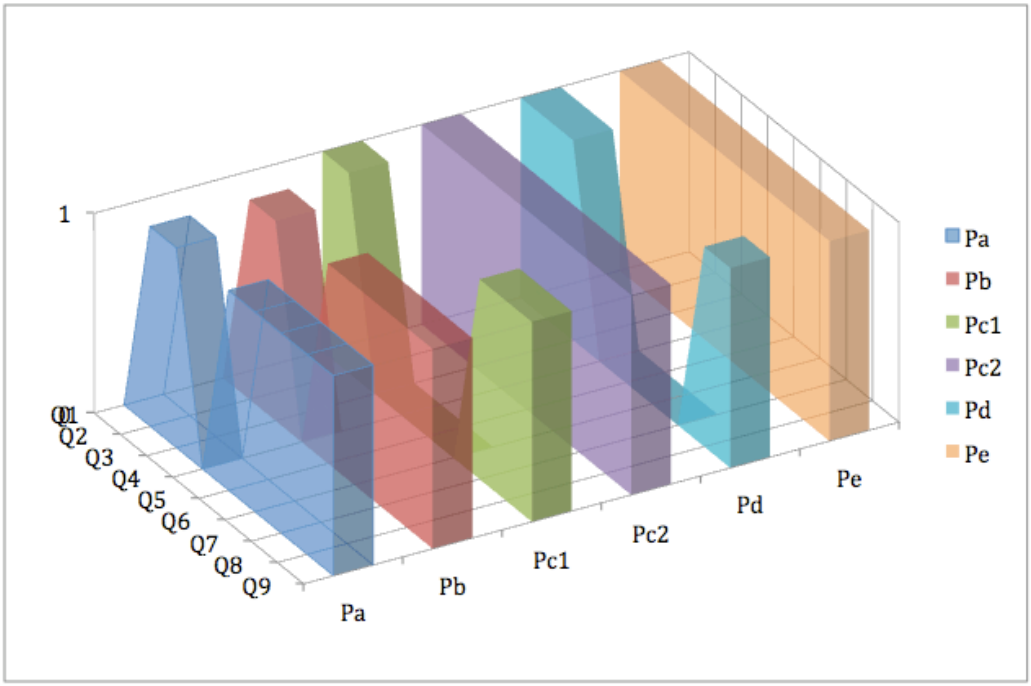

Figure 10-8: Participant performances by question/tasks (Q1-Q9)

The trends for the different participants show that Q1, Q4, Q5, Q6 were the failed tasks.

Pa and Pb both failed the first task (Q1). Nonetheless, analyzing the exploration behaviours we reckoned that this failure is due to a wrong interpretation of the question/task, and not usability or information structure problems influenced the results.

Pc1 were the only one to fail Q3. Analyzing the evidences given in the behavioural experimentation analysis we can reckon that this failure was due both to the task difficulties and the inexperience and personal attitude of the users. As also shown by the personal performance of the couple Pc1 (55.56% of succeeded tasks) this couple was often getting stuck because of disagreements on the way of proceeding or because of problems in interpreting the task more then in using the tool for facing it.

Q4 was the task that was participants failed the most. Four out of six participants did not succeeded. Contrary with the expectation the failure was due just for two of the participants (Pd and Pc1) to major problems in exploring the tool or understanding how to face the task. Pa and Pb were just following other logic to answer thereby they did not follow the experimentation logic but they were able to successfully accomplish the task and to give detailed answer to the question. Thereby also in this case we can see how the system was actually a good support different logics and strategies of exploration (see the case of Pa and Pb in Q4).

Pd and Pc1 encountered problems in Q5 and Q6, they did not notice the view of summary thereby the tasks were difficult to accomplish as also shown by the time of performance trend.

Q7 was failed just from Pd that was the only participants that did not catch the meaning of CON icons and links and thereby could not identify conflicts and disagreements.

In no case participants encountered problems on Q8 and Q9, they answered correctly and fast, sign that the spatial view and argumentation were easy to identify and understand.

Table 10-6: Succeeded tasks per participants and question

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	% of succeeded tasks
Pa	0	1	1	0	1	1	1	1	1	77.78
Pb	0	1	1	0	1	1	1	1	1	77.78
Pc1	1	1	0	0	0	0	1	1	1	55.56
Pc2	1	1	1	1	1	1	1	1	1	100.00
Pd	1	1	1	0	0	0	0	1	1	55.56
Pe	1	1	1	1	1	1	1	1	1	100.00

The trends of time performances per participant and task show that, not surprisingly the participants who followed the experimentation logic in 100% of the cases Pc1 and Pe were also the faster. Moreover a clear pattern in the time performances can be identified (see Figure 10-9) for Pc2 and Pe. This is further evidence that the experimentation logic is correct and interprets correctly which are the patterns of exploration that the participants should follow in order to exploit system features at the best and to be effective in accomplishing the tasks.

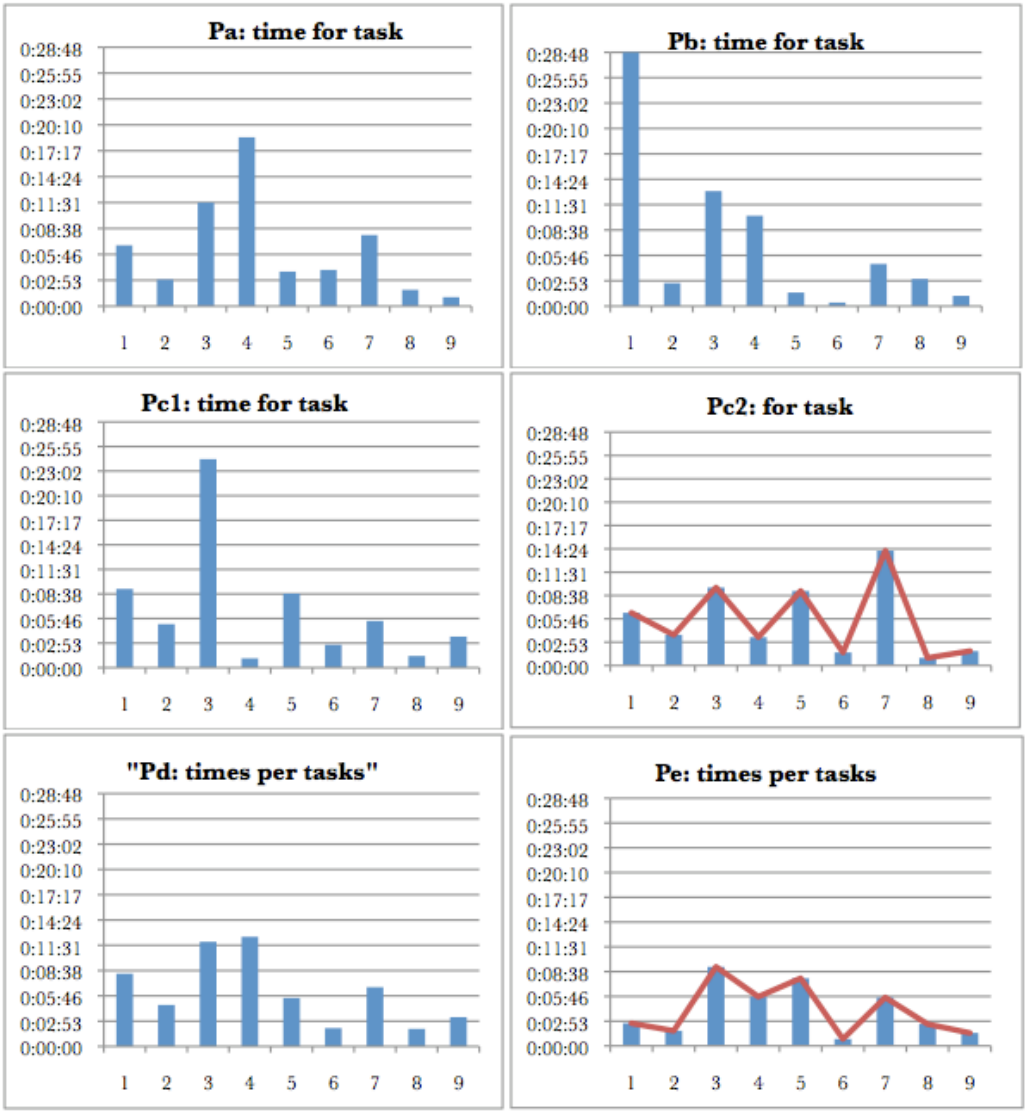

Figure 10-9: Trends of Time Performances per Participant and per Task

10.7 Discussion

In this chapter we reported the finding of our second evaluation study which aimed to answer RQ5 and to test the hypothesis we made that: *a process memory platform can help to effectively represent, take trace and manage knowledge in participatory planning.* As specified in section 10.1 we did so by driving a tool usability study and a tool interaction analysis in order to test both the tool and the information structure used to structure data in Compendium.

We will drive our discussion by summarizing the answer to our research sub-questions:

- Qa: How people interact with the system and how do they use it to extract information about the process?
- Qb: Is the system easy to use and explore?
- Qc: What do people like dislike about the system?

In the following we address the above question one by one.

Qa: How people interact with the system and how do they use it to extract information about the process?

The answer to this sub question is given in details in sections 10.3 with the description of the behavioural experimentation and the discussion of the experimentation results.

The experimentation logic that has been built to analyze and interpret the data and consequently to drive its evaluation have proved to be correct and to interpret the observed interaction phenomenon. Users' answers were close to the experimentation prevision in the 78% of the cases. This means that the system testing was successful, that is to say that data structure is clear and project retrieval is easy for the users. This also implies that the experimentation logic is correct and adequate to explain users' behaviour. Thereby we can conclude that the experimentation logic answers Qa and describes successfully the way *people interact with the system and how they use it to extract information about the process.*

In the following we report in green italic the main conclusions that can be drawn by paraphrasing the experimentation logic:

The system is capable to effectively communicate general info about the planning project.

The home view appears to be well organized and it successfully assists the users in system exploration and in information retrieving. Users successfully identify the Actor view and starting form it they are able to navigate into the system. Same contents can be accessed from different views. Each view works like a content interface.

When asked to identify the key actors of the planning process, users are able to go deep in the exploration path and to access nested information. The knowledge structure results intuitive and effective also for new users. We have evidence that, even when there are several ways to answer a question depending on which criteria the participant chooses, the knowledge structure is able to support multiple strategies of exploration and it supports participants in finding a satisfying answer despite the chosen criteria.

Users are able to infer and discover tags and icons features by simply exploring the system.

To extract information about who raised more problems and ideas, participants go to the actors' view and then chose an organizational group. Then they select a single actor inside the group. From the single actor view they are able to access the list of statements the actor made. While doing so, they are also able to recognize and make sense of the icons and the tags associates to each statement.

The view of summary is easy to detect and use. Participants explore this view to specifically identify the summary of all proposals and problems raised during the consultation meetings. They easily open the view of summary and, from there, they open the lists of project proposal and problems. Moreover, from each list they retrieve information about the actors and recognize the statements type by looking at the icons in the list.

The IBIS icons and link label meanings appear to be intuitive for the most of participants. They use these meanings to accomplish their task. In particular when they are asked to identify conflicts and disagreements they explore the system looking for the CON icons, because they intuitively interpret them as conflict indicators; alternatively they looks for red link labels called "object to". After that they read and follow the CON links in order to paraphrase and understand the discourse and the disagreement issue.

The spatial view appears to be effective in order to locate the project geographically and to organize and represent spatial arguments. In order to identify the geographical area of interest of the planning project users access the spatial view form the home view. They do not encounter any problem to read the spatial arguments as represented in the spatial view.

In addition, we presented detailed explanations, case by case, of why it has been respected and thanks to which feature of the system, or why it was not respected and for which reason. In the cases in which the failure was due to errors in the evaluation protocol, the protocol has been revised and ameliorates until the last version (see section 10.3.2).

- Qb: Is the system easy to use and explore?

The answer to this question is argued in section 10.6 Evaluation questionnaires have been distributed to the class of planning students (20 students) and to the 8 participants involved in the behavioural experimentation in order to test 'the perceived Ease of use of the tool to accomplish the nine tasks'. Results show that the perceived Ease of uses very high. Participants rated as 5=very easy almost all the tasks, with some exceptions. In particular Q3 and Q7 are the tasks which gave more problems. Q3 has been considered difficult because participants needed to choose a strategy of exploration between many possible ones. Which means that the mot of the difficulty for participants has been deciding how to proceed more then using the system for doing it. Q7 on the contrary was considered complex because of the need to deeply understand discussions that were represented with an IBIS syntax. Furthermore, as we can notice in Figure 10-10, Pe is the person who gave lower rates to the easy of accomplishments of the nine tasks; despite the fact that she is the one who performed the better and the fastest. She considered Q3, Q4 easy but not Very easy because the task itself was quite challenging so she had to explore a bit randomly at the beginning in order to make up her mind on how to proceed. She considered Q5 and Q6 'yes/no easy' because, in order to answer fast the questions she needed to find the view of summary, that she considered key for the exploration indeed. And in her opinion the information organization, and in particular the home view was not putting enough in evidence this information. Finally she considered easy Q8 but she rated it as easy because she did not appreciate the quality of the geographical information.

Thereby we can certainly argue that participants considered the system easy to explore and to use in order to accomplish the nine tasks.

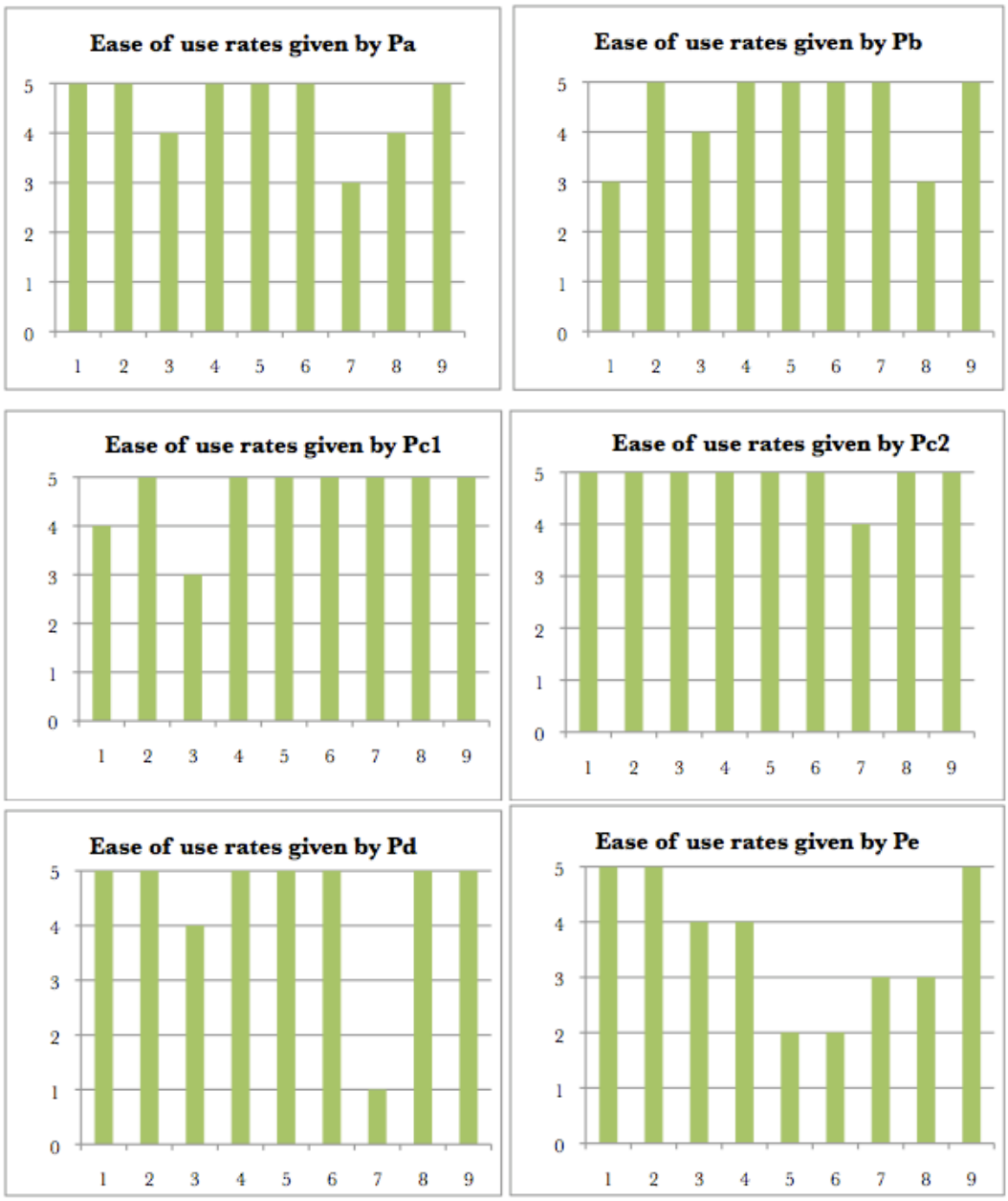

Figure 10-10: Ease of Use Rates Given by the Participants

Moreover results of the behavioural experimentation show that system usability problems that have been encountered in the real interactions user-system are of minor importance. Results are summarized in the following table, which shows the final coding schema for the three codes' categories: *Problems and Suggestions stated by participants, Software features recognized by participants and Encountered Usability Problems* (Table 10-7).

As we can see in the following table the codes' category *Encountered Usability Problems* is consisting of three sub-categories which summarize the three main categories of reasons for the success/failure of system explorations that have been identified trough the final coding schema: 1) Personal attitudes/capabilities 2) system features and 3) Project Representation.

Table 10-7: The Last Coding Taxonomy with Additional Sub-Categories of Interpretation

CATEGORY	SUB-CATEGORY	CODE
Software features recognized by participants	Community oriented features	Support community to discover their local identity
		Consensus building
		Discovering community-knowledge
		Support to explain the LOGIC behind solutions/decisions
		Useful to identify conflict points
		Widening community participation to problem definition
		Follow single actor reflections
		For institutions: to know community need so that these can be addressed with project
		Frame single actors way of reasoning
	Planning expert oriented features	Extract directions to solve design problems
		Extract knowledge from discussions
		Focus on relevant issues that otherwise could be dispersed in the consultation process
		It supports the work linking new data to any reference or data, reducing paper artefact
		It is a technical tool for practitioner
		Knowledge structure helps to organize information by categories
		Mapping discussion
		Organizing and ordering between raised issues
		Possibility to refer discussions to any kind of reference
		Representing spatial discussions
		Support discussion understanding trough IBIS icons
	Community oriented /technical oriented / institutions oriented features	Legitimate solutions
		With the view of summary the system helps to summarized what happened and then to explore details
		Ready- consultation/exploration
		Ready retrieving of information
Problems and Suggestions stated form participants	System	Difficulty in understanding and using the left and right numbers
		Discretional categorization
		Numbers in the list are useless and misleading
	Information structure	The view of summary is extremely important
		Temporal view describing process evolution
		Too many way to reach the same information makes difficult to memorize
	Project Representation	Understanding IBIS icons meaning- a legend could be add to each view
		Avoid conflicting or double direction arrows
		Improving representation of links and underlining better conflicts and proposals
		Node icons too small and similar to each other
		Missing contents: Contents are not complete updates, did not follow the c. evolution
		Pictures and maps as node images

		Project area need to be locate into a wider geographical framework
		Represent one info with the same visual mean: always list of always node
		Spatial view not effective and complete
		The theme of discussion and the starting question in not clear
Encountered Usability problems	Personal attitudes/capabilities	Don' understand node type
		Do not follow question-answer nodes interpretation
		Do not read links' label
		Do not see some nodes
		Do not see the left down number
	System features	Opening/Closing nodes
	Project Representation	Problems with arrows' orientation
		Isolated nodes
		Key words used with double meaning

The coding schema shows that users' personal attitudes/capabilities affected system usability and in particular usability problems occurred because participants did not notice and/or understand system visual features or they simply did not notice some of the nodes in the views. In particular some of them were not able to properly recognize and effectively use the IBIS visual language (i.e. sometime they did not recognize node types and did not read node labels, or they did not follow answer> question links), moreover the most of them had some problem to understand and use the numbers at the right and left side of nodes' icons.

Almost no system usability problems have been recorded, a part a minor problem of opening/closing node. This was due to the fact that compendium nodes label are editable from the users, thereby when they clicked on the label they activated the text edit instead of opening the node. Anyway it took just some minutes for the users to learn that they had to click on the icons to avoid the inconvenient. In fact none of them mentioned this as a problem in the final evaluation questionnaire.

Other usability problems were due to errors in the project representation. In particular some of the maps had arrows in opposite direction and this made the reading very difficult for participants. Also, participants seem to be not keen to easily interpret the meaning of isolated nodes. It is interesting to notice that especially the users who showed confidence with the IBIS model of argument representation criticized isolated nodes. As soon as the users got to understand how to read an argument map, they were always looking for the Moreover an error has been discovered in the use of 'keywords'. We classified the claims in four categories: problems, needs, project proposal and resources. We used this classification to represent meeting summary, generating four lists with all problems, needs, project proposal and resources raised during the meetings. At the same time one of the discussion view has been titled 'project proposals'. Thereby three participants out of six revered to this discussion view in order to list project proposals instead to refer to the list of all project proposals given in the view of summary. We can reckon indeed that particular attention should be paid to avoid the use of same keywords for different functions.

Finally we can argue that the system is easy to use and explore. Both the perceived Ease of use and the usability performances proved in the interaction study are high.

In fact the experimentation proves that none of the encountered usability problems can be ascribed to the system (Compendium), but rather depend on users and knowledge manager expertise, capability and attitude toward the task.

- Qc: What do people like/dislike about the system?

The answer to this question is detailed in sections 10.3.5, 10.4 and 10.5. We can draw overall conclusions on what people liked/disliked about the tool and the planning project representation by:

- discussing the answers behavioural experimentation participants gave to Q16 and Q17 (10.3.5),
- discussing expert interviews results (section 10.4) and by
- quoting the answers students gave to the evaluation questionnaire distributed after the experimentation with the class of planning students (section 10.5)

For the evidence presented from the analysis of the expert interviews and post-evaluation questionnaires they have already being discussed in 10.5.1 and 10.5.2. Generally speaking people's reaction to the tool is very positive. They like the tool and they consider it useful for several tasks/aims. Detailed description of what they like and the potentials they envisage in presented in 10.5.1, while what people dislike about the tool and the risk they envision are reported in section 10.4.3.

Further evidences can be gathered by the direct observation of users-system interaction (behavioural experimentation). While testing the tool, participants spontaneously described system problems and suggestions. These problem/suggestions have been classified in three sub-categories of interpretation that express if the problems/suggestion regards:

- the system;
- the information structure;
- the project representation.

As shown in the final coding taxonomy reported in Table 10-7, some problems regard difficulties in understanding and using system features. These are not major problems, in fact as also suggested from the users, the problem can be easily avoided by explaining visual system features before to start the experimentation or by adding a legend which explain nodes' features by default in all the views so that the users can have this info within reach whenever they need it.

Whereas a major problem of the system that many users recognized it the 'discretional classification'. Users seems to be aware of the benefits that the system can give thanks to his information classification and representation, (see in example expert interview to the planner in section 10.4, Pc2 answer to Q16 in section 10.3.5), nonetheless it is a general concern that the classification of claims is discretional and entrusted to the knowledge manager (the expert planner), and thereby it can bring to misinterpretation of stakeholders intentions or meanings, and also it can prematurely frame the problem setting by narrowing free concept interpretation.

11 General Discussion

In this chapter we present how we addressed the research questions, we discuss the key results and propose further research directions. We discuss observed advantages of the process-memory platform for planning practices both at technical, political and community level. Moreover the critical analysis of the results will show limitations and risks of the use of the memory platform. Starting from this considerations future work and system evolution will be envisioned, recalibrating objectives and strategy to new research challenges. We conclude reflecting on the role played by the memory platform in supporting legitimacy versus transparency of planning decisions. Transparency in participatory planning processes is presented as a "buffer" against the unavoidable gaps of uncertainty and complexity in planning practices.

11.1 Key Results

Participatory planning is a collaborative decision-making process in which different people and organizations, at different organizational levels, interact and deliberate over planning actions and scenarios for the future of social commons and spaces. These processes must elicit, manage and validate large amounts of information and knowledge. Planning knowledge takes a *multiplicity* of forms, coming from different people and documentary sources, designed to accomplish different tasks. It is *pluralistic*, as the expression of different perspectives. It is *evolving* because it changes in terms of time, space, social context settings and interpretations.

The challenge this thesis addresses is to trace the intense process of information and knowledge exchange and production which happen through deliberation and reflection. This converts in loss of democratic sharing of information and weakening of transparency and accountability of the planning decisions.

In this problematic context the research presented in this thesis has the overall aim to enhance transparency of decision-making and provide accessibility to the information and knowledge base used to take planning decisions. This goal has been addressed by supporting representation and management of information and knowledge in participatory planning practices.

We proposed and developed a process memory platform which allows us to represent in an integrated environment the information produced and knowledge generated throughout deliberation in a participatory planning process.

The research programme developed in a multi-disciplinary environment, founded on approaches and theories coming from different fields of research such as communicative theory and participatory approach to planning and Organization Theory, Argumentation theory and Computer Supported Cooperative Work (CSCW) in order to explore new methodologies and technologies to face and support Participatory Planning Processes (PPP).

Exploring these fields of research we motivated the need of a process memory platform for participatory planning and clarified the nature and the function of a process memory system for participatory planning.

11.2 The Role of the Process Memory in Enabling Participatory Planning

This topic has been discussed by addressing the first research question:

RQ1: What is the role of process memory in enabling participatory planning?

Firstly we argued that participatory planning requires a process memory tool that is more than an organized database. Because of the nature of planning issues, and the character and role of knowledge in planning, the process memory platform needs to make multiple information and knowledge become dynamic contents living and changing over time with the planning process evolution.

The memory platform makes the contents dynamic by supporting multiple representations and multiple contextualisation of the same information and knowledge; thus enabling multiple interpretations and insights which can change over time and with the individuals. What makes the contents living and changing is not the tool but the skills and interpretations of the stakeholders that use it. The memory platform does not make contents dynamic but enable dynamic interpretations. In this sense the memory platform enhances participatory process by opening the possibility to access and interpret information and knowledge in planning to a wider community of stakeholders, at different organizational levels, with different means, and in different environments.

Thereby the process memory platform enables better participation in at least three different ways:

- promoting more reflective interaction between the stakeholders by making tangible the connections between planning options, arguments and other issues/documents;
- building common awareness and understanding, not only of the planning issues at stake, but also of the diversity of viewpoints and counterarguments in play;
- maintaining coherence between the past and the future, by helping stakeholders to navigate the history of the project in multiple, helpful ways.

We argue, therefore, that the memory platform is first of all a tool to enable reflection, understanding and coherence. It can be used at different organizational levels and with different purposes.

Figure 11-1 shows the three main organizational levels, and the potential transactions and transversal roles of the process memory system for cross-organizational exchange and generation of information and knowledge along the process.

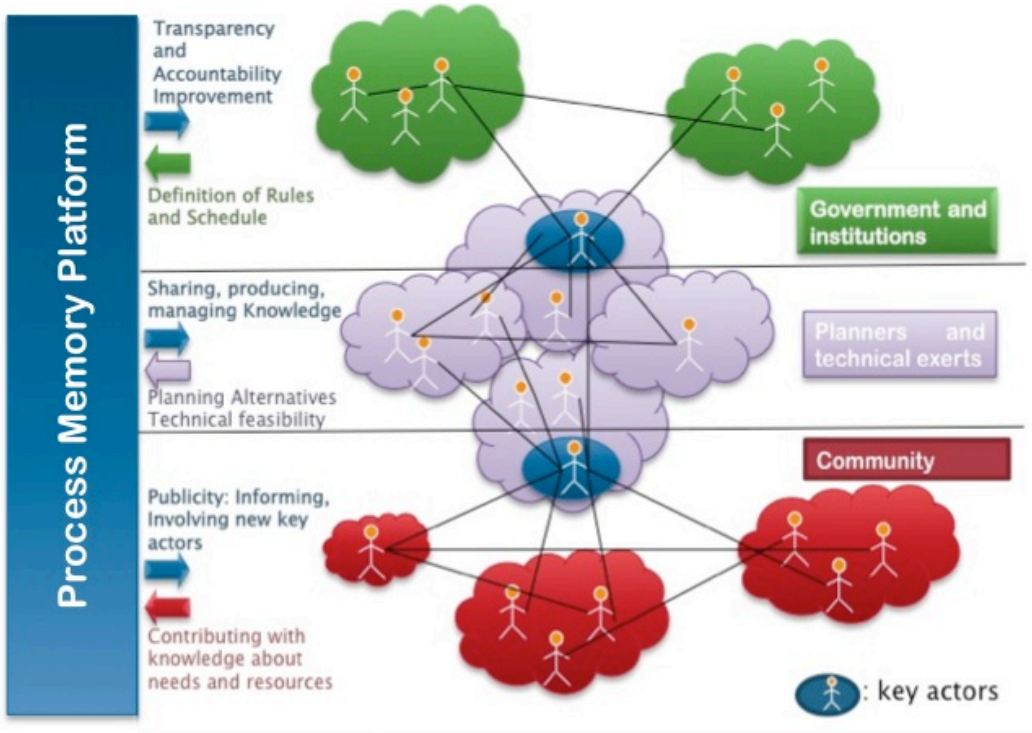

Figure 11-1: The Memory Platform Transactions at Organizations' Levels

At the *community level*, people can use the platform to reflect on what is going on in the planning process and to understand what are the issues at stake. Moreover they can better understand what are the positions of the different stakeholders and what are their arguments to justify these positions. Finally the community can use the memory platform to check the coherence between what has been said and what has been done. Thereby it is a tool to enable transparency at community level.

At the *technical level* the process memory platform can be used by planners to have a more precise idea of what are the problems to address and how the community is lined up in respect to these problems. The process memory platform provides a precise picture of the social endeavour in which the plan will be implemented by capturing planning conversations and representing people ideas, positions and claims toward the planning issues at stake. Thereby for planners the memory platform is not only a tool for reflecting and understanding, but also a tool for analysing the planning process as a 'social process': what are the needs and problems, what are the powers in play, what are the possible emerging conflicts? In the light of this social analysis planners can better understand the feasibility of planning solutions and make design decisions that better respond to the social environments and the community needs. In addition, the process memory platform as technical tool can be used to evaluate planning process performances and outcomes and to reflect back on possible reasons behind failures and successes. Also in this case, the platform supports this goal by enabling reflection on the deliberation process behind past events and decisions. Therefore the platform is also a tool for learning, it builds a collaborative project experience repository which, in the long term, can be used by planning organizations to reflect and enhance organization performances.

At the *political level* the memory platform is a means to enhance transparency and accountability of planning decisions. A local institution that makes transparent and accessible the process memory is at the same time making available to the public a powerful means to check and evaluate the coherence and equity of planning decisions. This helps institutions to be accountable and build trust with the community. Moreover as discussed before the memory platform supports the analysis of planning processes as social processes, enabling reflection and understanding of the powers in play, to help detect and anticipate conflict. Therefore politicians can use the memory platform to probe for, and respond to, community reactions and attitudes toward specific policy issues.

These cross organizational potential uses of the process memory platform have been in part investigated by the following research questions, and in part discussed in the evaluation phase directly with the users. In the following subsections we discuss the further findings that we gathered in the evaluation phase.

We made progress in the direction of testing the tool with new users: people from the community, planning experts and representatives of local institutions. Overall, the platform proved to be easy to use and effective for information exploration and retrieval (see Chapter 10 for detailed analysis). Even though some of the users considered the memory platform too confusing to give quick answers to specific tasks, they appreciated the detailed information and the possibility to use this information in order to reflect and understand the deliberation process about planning issues.

11.3 Functional Requirements for a Process Memory Software Platform

This issue was addressed by the second research question:

RQ2: What are the functional requirements for a process memory software platform?

Participatory planning projects develop through heterogeneous meetings between stakeholders. We can distinguish two main meetings types:

- official and widely inclusive meetings, in which several people from different organizations and roles are involved
- informal meetings within organizations or working groups that are mainly internal meetings involving few key actors.

Official meetings are normally face-to-face and public meetings, while internal meetings are very often informal, and can happen in different modalities and in different environments of interaction.

While official meeting are more relevant in terms of knowledge dissemination between different working groups, internal meeting are typically where key stakeholders take relevant decisions about the project. Therefore, in order to trace project history with greater transparency, we need to include the results of both informal and formal meetings in the memory platform, in order to provide meaningful decision rationale that connects stakeholder consultations to final decisions.

In chapter 6 we have proposed and discussed a specific process memory platform architecture in order to support the capture and representation of those meetings (both formal and informal) (see platform architecture at Figure 6-1).

The main functional requirements of the platform can be summarized as follow:

- video recording and annotation of face-to-face meetings.
- video conferencing
- remote synchronous and asynchronous collaborative argumentation
- transparent integration of information and knowledge captured in these three modalities
- structuring and representation of information and knowledge in form that supports reinterpretation, recognises the importance of arguments, and promotes further discourse.

These functions have been provided by the integration of three tools which have been described in details in chapter 6.

The main aim of the memory platform is to support the capture and integration of information, ideas and arguments from different community groups and in different planning meetings, and to manage all these information and knowledge across:

- tasks (i.e. exchanging information from public consultation meetings and then using it as a reference for technical and political choices)
- context (i.e. exchanging information between different teams and organizations) and across
- environments (i.e. using face-to face meeting results to inform web-consultation experiences and vice versa).

RQ3: How can ICT tools be integrated to capture, structure and represent planning process memory?

We made progress in the direction of the implementation of such a platform. In particular three existing tools have been integrated according to the platform architecture and personalized in order to support the structuring of the process memory. The integration of the three tools allows us to capture different types of meetings and to represent them in a hypermedia knowledge management system.

Compendium is the core tool of the platform: a visual hypermedia and sensemaking tool which offer an open environment in which dialogues, narratives, conversational models, flux of thoughts can be represented and stored in different media such as texts, graphs, diagrams, tables, images, and videos. Compendium has been used as environment to build the planning process memory so as to capture, index, and visualize the issues, options and arguments generated throughout the project trough planning meetings and conversations. This is a first step toward a "comprehensive issue management system" (Conklin '05), which starts from meeting representation and try to maintain and organize the meeting contents in order to make it easier the retrieve and exploration of the growing amount of formal and informal information about the project generated during each meeting.

The second component of the platform is *FM*. FM is an application that allows a dispersed group of people to meet in a "virtual meeting room" in which they can

see and talk to each other. For our purposes FM has been used both: i. to allow remote, online meetings between stakeholders involved in the planning process and ii. to video annotate face-to-face meetings of technical teams, political teams and/or local community groups, in order to preserve transparency when tracing and representing deliberation.

The third component of the platform is *CoPe_it!* on-line argumentation support tool which follows an argumentative reasoning approach. CoPe_it! provide an online workspace to enable collaborative discussion in an IBIS model of argumentation, not possible in the single-user Compendium tool.

In the thesis we presented results of the post-hoc analysis of meetings' videos in which a planning analyst (the author) extracted images, information, and knowledge claims transcribing and editing the videos and then structured these data in the hypermedia database. This operation introduces a relevant level of discretionarily.

The integration between Compendium and FM solves at least in part this problem. Video of meetings can be annotated on the fly during the meeting with FM and then annotations can be imported in Compendium hypermedia database. A new procedure of integration between Compendium and FM has been tested for video recording and annotation in face-to-face meeting. In Compendium environment, FM-videos annotations are converted in indexes to the video-replay and are used as references for the knowledge claims and concepts. In this way, when navigating the meeting contents, users can replay the meeting pointing to the moment in which the specific claim has been done. This feature is a powerful enhancement to capturing deliberation because it makes the deliberation process fully transparent.

The second challenge addressed by the process memory platform is to support these and other activities on-line giving the possibility to a wider community on the web to participate to deliberation. In fact the integration of Compendium and CoPe_it! allows extending discussions and deliberation started during consultation meetings to a wider community on the web. Cope_it! can be used with different communities (planners, citizens, technical groups) to discuss different topics and themes emerging during the planning process. Small on line communities can be emerge or created ad-hoc to discuss specific topic. Results of on line discussion can be used to trigger off-line discussion in groups working in real world settings and vice versa results of off line meetings can be continuously updated to the WWW opening and widening the to specific on line community or to the all public. By providing this function the integration between Compendium and CoPe_it! enable the memory platform to couple on-line and off-line consultation into a unique process of knowledge exchange and production. On the contrary the integration between Compendium and FM enhance transparency in the capturing of the deliberation processes by linking represented claims to index of video replays, both in face-to-face and at distance meetings. Table 11-1 shows how the combined use of the three tools of the platform allows us to support information and knowledge creation in different environments, communication modes and for different planning activities. The thesis offers concrete examples of application of the tools in both consultation meetings (SPP, SPB case studies) and design meetings (MK, PAU, CS, TG case studies) (see chapters 7, 8 and 9).

Table 11-1: Communication modalities supported by the three groupware

	KNOWLEDGE COMMUNICATION MODES (Knowledge generated in the same or different geographical sites)		KNOLWDGE ENVIRONMENTS (Knowledge generated on-line or off line)		PLANNING ACTIVITIES CONTEXT (Knowledge generated during different planning phases)		
	Face-to-face	At distance	Real world settings	Virtual	Consultation	Design	Problem and strategy setting
COMPENDIUM	x		x		x	x	x
FM	x	x	x	x	x	x	x
COPE_IT!		x		x	x	x	x

RQ4: Which methods are appropriate for participatory knowledge acquisition, representation and management?

This RQ is addressed in chapters 8 and 9. Chapter 8 discusses different methods for information and knowledge acquisition in five case studies at different planning scale and in different phases of the planning process. Once information and knowledge have been acquired they need to be structured and represented in the knowledge management system. Chapter 9 describes in detail the activities that the knowledge manager should perform in order to annotate and organize the gathered information and knowledge in order to build the process memory representation. In particular we described how Compendium is used to implement an information architecture and annotation scheme specifically designed for tracing deliberation in planning conversations. The annotation scheme (section 9.4) and the information architecture (section 9.5) have been developed to apply the knowledge taxonomy proposed in section 3.4 in order to test the effectiveness of the envisioned knowledge taxonomy in a real case study.

SPP case study (see chapter 9) provided authentic material to drive the design of the first version of the information architecture and to test the envisaged knowledge taxonomy. Results of this application and of the evaluation study give evidence that the knowledge taxonomy coupled with the use of Compendium offers a valuable support to the managing and tracing of information and knowledge in participatory planning projects. The knowledge taxonomy proved to provide an effective classification and representation of information and knowledge extracted by planning conversations.

The main objective the knowledge taxonomy allows to reach is the possibility to represent knowledge fragments in different dimensions according to their relevance to different contexts. This implies two kinds of benefits.

Firstly it allows exploring new connections between knowledge objects (knowledge fragments and knowledge claims) represented in different contexts thus discovering impacts of facts, assumptions and claims across different contexts. This capability is enabled by representing knowledge in multiple contexts and by making connections

across different contexts. Each user can, by looking at a single knowledge fragment (reached exploring a specific dimension and accomplishing a specific task), have visualized and explore all the additional dimensions or contexts in which that knowledge fragment has relevance.

Moreover the second advantage of the knowledge taxonomy is the possibility to represent knowledge objects by theme. Each theme works like a lens through which the user can view and explore the contents of the memory system. Each theme offers a view of all knowledge objects which have a relevance to that theme. This gives the possibility to have a view on all the knowledge objects but contextualized to specific key dimensions (the chosen themes). This allows planners to visualize new situations of proximity between knowledge objects. For example, if we are interested to explore the issues by geographical area of pertinence, we can select the geographical view. In this view knowledge objects that were apparently distant in other contexts (i.e. in the time view, because they happened in different meetings; or in the conceptual view, because they happened during different discussions) are grouped by geographical proximity. This proximity or relation can be hidden if we accessed a specific knowledge object from a different exploration path. So the knowledge taxonomy allows planners to discover new connections and make sense of knowledge objects explored by theme.

Thereby we can conclude that the heuristic knowledge taxonomy offers a good classification of what are the knowledge contexts in which knowledge in planning needs to be represented in order to manage information and knowledge gathered in participatory planning processes. Moreover the annotation scheme and the information architecture give a concrete and appropriate method for participatory knowledge acquisition, representation and management with Compendium. Following the suggested methods Compendium provides a visual hypermedia application with rich linking to support navigation within and between the five different dimensions of the memory space which mirror the dimension of knowledge interpretation and creation suggested by the knowledge taxonomy.

11.4 Observed Advantages and Potentials of the Process Memory Platform

11.4.1 Easy to Use and Explore

RQ5 asks specifically: *Is the participatory process memory platform effective?*

This research question has been addressed in chapter 10. This chapter present the main evidences gathered by the evaluation study and prove the effectiveness of the participatory-process memory platform. In particular RQ5 is addressed by answering the research sub questions Qa, Qb, Qc reported in section 10.1. Here we summarize the key results.

The system testing was successful, the data structure proved to be clear and the project retrieval easy to perform by the users. The experimentation logic describes successfully the way people interact with the system and how they use it to extract information about the process.

In general terms the system was capable to effectively communicate general information about the planning project. Contents appeared to be well organized and the memory platform application successfully assisted users in system exploration and information retrieval.

The knowledge structure was intuitive and effective for new users. We have evidence that, even when there are several ways to answer a question depending on which criteria the participant chooses, the knowledge structure is able to support multiple strategies of exploration and it supports participants in finding a satisfying answer despite the chosen criteria. Users demonstrated that it was straightforward to discover and infer the role of tags and icons by simply exploring the system.

The IBIS icons and link label meanings appear to be intuitive for most of participants. They use these meanings to accomplish their task. The spatial view appears to be effective in order to locate the project geographically and to organize and represent spatial arguments.

We argue, therefore, that the system was easy to use and explore. In fact we concluded from the study that none of the encountered usability problems can be ascribed to the software (Compendium), but rather depend on:

- the user's capability and attitude toward the task, and
- the knowledge manager's skills in issue mapping.

Detailed description of the gathered evidence can be found in sections 10.6 and 10.7.

RQ6: What potential and risks does the memory platform hold for participatory planning?

The answer to this question has been provided reflecting on the results of the evaluation study. One of the major results we achieved through the evaluation study comes directly from the hands-on experience with the users. They spontaneously recognized a set of system features and potentials during the study and they expressed it in the post-session evaluation questionnaire. Considering that the study was not preceded by any introduction or description of the system itself and of its aims, we conclude that participants' feedback was grounded in their actual use of the system, albeit brief (and bearing in mind that students may provide over-positive reactions if they think this is what is expected or hoped for by more senior researchers).

We now present the main observed advantages and potentials organized by emerging topics. In italics we will report all the feedbacks from the 20 planning students, the two experts involved in the interview and the eights participants to the behavioural experimentation (four students, two researchers, two planning practitioner from ISF).

11.4.2 Representing Multiple-Context and Supporting Multiple Perspectives

One of the key features of the SPP case study platform which participants appreciated was the "*possibility to look at the themes and issues emerging during the participatory process under different perspectives, and to re-use gathered information and knowledge also in the following phases of the planning process*". This means both that they appreciated the knowledge taxonomy chosen to structure and represent information in several views and that they appreciated the tool feature of tracing

the planning process memory. They liked the multiple-context representation because it offers multiple perspectives on the planning process. In this way the system helps planners to enrich the knowledge base gathered and used during these processes. Moreover it helps the community to understand what is going on and to be aware of different point of views on problems

11.4.3 Supporting Participatory Design

Users also recognize the tool as a very good support for participatory design experiences. In particular it can be used to capture "*the moments in which the creativity of the actors and the interaction between them develops*". The users suggests that the tool can be used to capture collaborative-design meetings and "*designers can use the tool to analyze, inquiry, explore, connect and then go much deeper in the process after the meeting. They can reflect on words and events they did not catch or that slipped their mind during the design process. So hopefully they can go back to some of the key points, revise them and even present them again in other meetings to be discussed with the design group.*" This claims shows that users directly recognize as a major advantage and potential of the memory platform the "*possibility to better reflect and act during the process*".

11.4.4 Supporting Deliberation and Decision-Making

Users consider the tool very useful to provide a very rich representation of the deliberation process that can be used to reflect on planning decisions and to support decision-making; they think that "*the categorization of information (the information architecture) provides rich data about the deliberation process and these data can be analyzed and manipulate in many different ways to support the decision-making process*". In example the tool can *offer a rich representation of the critical issues for decision-making such as: defining what is the problem; what are the objectives; and supporting decision maker to reflect and look for alternatives.*

11.4.5 Summarizing and Schematizing Information

Users opine the tool *can provide a quick vision on problems and on participants so that you can understand what is going on*. They appreciate the system capability *to frame the main problematic setting and to get suggestions form the lay people.* The tool *collects and order information on the community* and it provide users with *details on each stakeholder*. Moreover users opine the tool *schematizes clearly information about the project and in particular the contents of consultation meetings*. This information is considered very useful for planners to face the design process. They also reckon it has a user-friendly interface.

11.4.6 Supporting Reflection and Understanding of the Deliberation Process

Users particularly appreciated the use of the tool *to support reflection in action*; they describe tool as *a mean to investigate the process, to understand the problems, to explore solutions and also to understand how to make these solutions operational on the territory.* Being a tool that trace and represent design deliberation conversation the tool can help stakeholders to make sense and *to argument about the evolution of any kind of event that involves several stakeholders.* It can help to observe opinions and proposals raised from the whole community. It is a support for the community to better understand project proposals and the related discussion and answers given about these proposals.

It helps to reflect on deliberation contents in order *to investigate and to find the right balance and combination between community needs and exploitation of local resources and potentials*.

If used in this way the system can *help to draw a plan that is compatible with the community interests and demands.* Moreover, being a tool to support reflection and to allow deep analysis of the deliberation contents and of the social context which generated it, *it can be used to continuously revise and adjust the plan to the community needs* as long as they evolve along the process with the planning and social context.

11.4.7 Supporting Participation

Users considered the tool useful *to gather and frame community demands and needs on several subjects.* Users see it first of all as *a tool of inquiry and as such they suggest using it to discuss with the community about design alternatives and possible problems solutions.* It can then be used first of all *to engage the communities* in an open discussion about the planning issues at stake. Moreover it offers a different way *to give voice to people that would not have one otherwise* and it allows to effectively using these voices in the design process. The tool offers new ways to capture, gather, structure and represent lay people knowledge so that this can be explored, analyzed and made operational in the real process of design. Also Users opine the tool can *help to identify and monitor which answers to people needs have been given and which measures have been really put in practice from the institutional agencies.* It offers a good support *to verify to which extent the planning practice keeps or have kept in regard the real needs and demands moved from the local communities.* In this sense it has been considered a good tool to test the real extent of participation in the planning process. It is a tool for evaluating and testing planning projects performances in terms of degree of knowledge base used, fulfilment of community demand, identification of excluded voices etc.

11.4.8 Supporting Conflicts Resolution and Synergy Discovery

Some of the users appreciate the possibility to use the tool to identify agreement and disagreement. They consider the tool a good mean *to facilitate comparison between people, and eventually to solve disagreements emerged during the meetings*. It can help *to identify problems and proposals that are agreed from the community and that thereby would not encounter any obstacle if and when implemented.* Namely, the tool can help to reflect on the social implications of design decisions in order to anticipate and avoid conflicts and or to exploit synergy of actions. Also it is a good way to test design decisions' feasibility and possible obstacles to implementation.

11.4.9 Supporting Planners and Local Institutions

Users considered the tool a very good tool of reflection and analysis *which enable to gather a deep understanding of the problem setting. In particular by capturing community meetings it can help* to identify and analyze problems that are tightly connected with the community, to understand the local situation and on the light of this to choose the direction that the planning activities will try to address. Being a tool of analysis it helps planners *to evaluate the feasibility of the different ideas and suggestions in relation to the technical constraints and to draw a plan that is compatible with community interests and demands.*

Moreover users suggest that local institutions could use the tool on the long run to identify the most recurring problems and demands. This can be used as a means and criteria to define priorities for the local communities.

11.5 The Risk of Tracing Process Memory

Software is not neutral, but embodies models of the world from one or more perspectives. Nor is transparency in planning neutral, but an explicit bias towards openness and accountability. We next consider some of the cautions and risks associated with the approach investigated in this thesis.

11.5.1 Discretional Classification

A major dependency of the memory system that many users recognized is what we might call 'discretional classification'. Users were aware that the benefits that the system afforded depended on its information classification and representation, with a general concern that the classification of claims is discretional and entrusted to the knowledge manager (the expert planner). This opens the possibility of misinterpreting stakeholders' intentions or meanings, or prematurely framing the problem setting by narrowing free concept interpretation.

The classification challenge lies at the heart of all information/knowledge management systems (Bowker and Star, 1999) so cannot be escaped. The approach investigated in this thesis uses the IBIS classification scheme to explicitly open up rather than close down interpretation, as well as an open-ended tagging scheme. Once the platform moves to the web, a 'folksonomic' social tagging approach could be provided to ensure that classification is open to all, or to appointed stakeholders, as negotiated within the project.

11.5.2 Information Structuring: A Trade Off

There is a clear trade-off that came out of the evaluation study between what we gain and what we lose by structuring information. Information structuring supports the user to understand and use information and to create knowledge that can effectively be operationalized along the planning process. The potential problem is that any kind of classification and order to data undermines the free and creative interpretation of information, the legitimacy of the representation we create, and of the use we make of gathered information and knowledge during the planning process. The knowledge manager's interpretation is to a certain extent already manipulating and elevating information to a kind of knowledge, and this should be borne in mind when facing matters of legitimacy. While the system captures raw data (video record streams, audio file of stakeholders interviews, official presented documents, cartography etc) the way this data is structured elevates that data to information giving them specific contexts and perspectives. These contexts and perspectives can be open to diverse interpretation and misinterpretation of data and facts as they occurred. Undeniably these interpretations/misinterpretation can be influenced and biased by the information structure we impose.

While none of the participants in our studies explicitly offered any specific warning of the risk that preliminary interpretation and structuring of data could cause, nonetheless the trade off exists and a clear position needs to be taken. In our

approach we decided to face the challenge of structuring information and knowledge developed in a participatory planning process. The research presented in the thesis proves that structuring information and knowledge in planning can improve the representation, understanding and re-use of these information and knowledge. Moreover the memory platform and the methods of knowledge acquisition, structuring and representation that have been proposed in the thesis try to mitigate the effects of the unavoidable trade-off between what we loose when we structure information in terms of free interpretation and what we gain by organizing and making easily accessible unstructured data. In fact the memory platform preserve the links between structured and row data. When navigating a map representing a planning discourse the memory system allows the users to easily access the raw data (video materials). This enables the user to eventually reinterpret and question the results of the knowledge structuring and representation.

11.5.3 Disorientation: Too Many Paths to Reach the Same Information

A second main risk envisaged from some of the users is 'disorientation'. Users opine that the process memory offered too many different way to reach the same information and this can be disorienting and discouraging, especially when, like in the their case during the experimentation, they have specific tasks to accomplish and answers to give. Some of the users asked for clearer illustration of 'key paths of exploration'. It is interesting to underline two claims from two of the participants.

"*I did not like the disorder of the icons and the repetition of the same information in more then one view. I think the system is confusing and lacking of a clear illustration of 'key paths of exploration'. This implies that the user needs to proceed giving a try and then another one since he doesn't create his own paths of explorations. This can unnerve the user, especially if he is trying to accomplish some specific tasks*"

vs.

"*I like the system because it is easy to use, diagrams are clear, I can read details on single participants, their comments, and I can analyze contents of discussions. I think that this tool is very useful to have a deep understanding of the problem setting. In fact, it allows framing in details the problems, putting in relation all the actors of the process. It gives the possibility to hear the voices of diverse actors distinguishing who is talking to defend a private interests and who is behaving as spokesman of the general interest of the community, and between them it allows to distinguish between different judgments of values and priorities. I would use it in a preliminary planning phase to understand the local situation and to choose the direction that the planning activities will try to address. After that I would use it to evaluate the feasibility of the different ideas and suggestions in relation to the technical constraints*"

These two claims are prototypical of two completely different ways to approach the system (see sections section 10.5.1 and 10.5.2 for other examples). Users that approach the system as a project database to give appropriate and quick answer to specific planning questions, unavoidably consider the system ineffective and 'messy'. They ask for simple, easy and fast path of exploration to access the rights and univocal answers, they look for tools which help *to generalize problem and solutions*. The memory platform as it has been conceived, designed and implemented is not a tool to give answers, but a tool to enable reflection and understanding between highly problematic, questionable, uncertain, unresolved, and contestable

questions. The main objective of the system is to convey, and remain open to, new understandings of complex planning situations. Thereby when navigating the system the users *needs to proceed giving a try and then another one since he doesn't create his own paths of explorations*. Multiple paths of exploration mirror multiple interpretations and understanding of concepts and arguments.

11.5.4 The Growing of Information Complexity: How to Select Relevant Information and Knowledge

Another problem raised by users is the problem of the growing of information complexity as a project scales. The memory platform produces a huge amount of information and knowledge even capturing a reduced number of meetings. It was not possible to test the system for long term planning practices so we are not able to answer how the platform would perform with the growing of number of meetings. It is to envisage that specific method have to be planned in order to narrow the number of information and knowledge that needs to be traced by the memory platform. Some of the users propose "*to narrow the number of involved actors to the representatives of local institutions and organizations and to narrow the represented statements the relevant ones, which means the one that really help to set the problems and find solutions*". Of course the notion of 'relevance' itself it is a questionable matter and it depends from many factors, such as the planning phase, the specific objectives, the specific problematic setting, etc. Nonetheless we want to make clear that the aim of the memory system is not to trace every single aspect of the project without any distinction. The risk is to reduce too much the grain of the information to trace and then to augment the amount of information and knowledge fragments to interpret and manage. As described by Jorge Luis Borges in his philosophical narrative "Funes the Memorious", about a man who was unable to forget a single detail of what happened in nature:

"He was, let us not forget, incapable of ideas of a general, Platonic sort. Not only was it difficult for him to comprehend that the generic symbol dog embraces so many unlike individuals of diverse size and form; it bothered him that the dog at three fourteen (seen from the side) should have the same name as the dog at three fifteen (seen from the front)…The multiplication of words would have perplexed their use, had every particular thing need of a distinct name to be signified by"

Funes is a man that has the capability to store in memory any single detail of any past and present event; so that he is constrained by his own memory and unable to signify anything in general terms. The story of Funes helps us to understand with a metaphor the oppressive sensation that can give the "remembering every single detail" and the load of an infinite memory of the past. The ability to remember everything translates into the inability to have any general meaning of any kind and about any topic.

Thereby this makes such a detailed remembering not only useless but also counterproductive. Thereby the problem of memory granularity is a relevant matter that needs to be addressed. It is important to make clear that the aim of this research was not to provide with a memory platform which could give as the ability to capture and remember as Funes did: any single indistinct detail. Thereby future efforts needs to be devoted to explore methods to screen between relevant knowledge to trace and the "noise" which just need to be forget in order to focus

our attention on what matter in the specific moment and for the specific people involved.

11.6 Tracing Design Rationale

In any participatory design activity the thread to represent the design evolution is the planning team rationale. This rationale stands in the interpretation of the process and its creative representation in a new plan performed by the planning team. Thereby this dimension ends up being very personal and interpretation bound.

The memory platform provides an extensive information and knowledge base to inform our decisions and to trace the rationale of those decisions. However, in order not to remain 'petrified in the dark' like Funes, unable to orient, make decisions and act, we need methods to create summaries, filters to orient in this growing amount of information.

One way to address this problem is selecting the important points/moments like i.e. decision moments. This can be 'enacted' like in a theatre piece; different ways to "declaim" decision moments can be envisioned and added to the system. By doing so, the decision is not just a record at open microphone of what people said in the meetings, but it is an interpretation collaboratively generated of what are the salient factors and the relevant moments to trace.

Making the time to slow down and craft "the story as we currently see it" fits with a participatory approach to collectively build and share design rationale. We can see at least five benefits of introducing this as a practice:

- reducing the impact of the interpretation filter discretionally introduced by the knowledge manager
- reducing the amount of information and knowledge to manage and represent by distilling complexity into succinct summaries
- reducing the "noise" and focusing on relevant information and knowledge
- including directly the stakeholders in the definition and interpretation of what is relevant to them
- augmenting the trust on information and knowledge represented.

The last three advantages are tightly bound. In fact if stakeholders are involved in the generation of this "intentional story" of decision moments, other people could be more incline to trust this story because it is collaboratively generated, it is the group interpretation of the events that lead to that decision.

Moreover, intentional stories can be built during or immediately after meetings, or reconstructed post-hoc after a process of longer reflection on the process itself. The need to focus on salient information, and the need to generate this collaboratively with the participants, has been also directly suggested by the stakeholders. As we can read in the interview to the institution representative, she clams:

"*In my opinion one of the key points is that every dimension of the process memory: social, spatial, temporal...is reconstructed from the observer-participant, the knowledge manager, who obviously provides a personal interpretation that is exactly what interconnect information in the system. Which is anyway useful, but if this could be also entrusted to the participants this could probably push participants to go back and reflect on their interaction, on the logical links made about facts*

and information, and they could "probably" also learn better and more from the participatory process"

The process memory can provide the means and the information base to support this reflection. To borrow the cognitive psychology metaphor, we propose a model of project 'long term memory' that actually supports stakeholders in the on-going phase by capturing the 'working memory' they use to interact and take decisions. While this working memory could be simply deleted as soon as the summary is collaboratively rehearsed and consolidated into the long-term memory of the project, software memory has some advantages over human cognition, in that we can if desired preserve the 'raw traces' from working memory (video footage; early versions of knowledge maps, draft design rationale stories, etc) — should we want the option of revisiting them, perhaps with wisdom in hindsight.

If we refer to our memory model (see section 5.4) we can conclude that at the discourse level the memory platform supports the working memory by capturing and representing planning conversations, while at the decision level the memory platform provides the foundation to create and represent design/decision rationale. This can be developed either by the knowledge manager, as discussed in 5.5, by creating decision maps or collectively generated by the stakeholders in form of intentional stories.

In section 9.7.1 we gave an example of how decision rationale can be represented through the memory platform. We proposed a decision template which helps to understand the reasons behind decisions. The decision template supports the exploration of relevant information in the memory system representing them in form of discourse schema. The discourse schema does not 'explain' the reasons behind decisions, but it filters relevant information in order to enable the users to understand decisions and eventually question them. This example shows how the memory platform can help users to trace the design rationale. The memory platform provides the foundation (the information base) and the means (the hypermedia tool) that both the planning team and/or collaboratively the stakeholders can use to trace the design rationale. However further research needs to be devoted to identify specific methods to use the memory platform to build and organize design rationale representations in form of intentional stories. Intentional stories are one possible expressive means to engage participant in the creation of the design rationale. They can take multimedia forms, multimedia summary reports, and video recording of participants enacting the summaries. These multimedia documents can be then stored, organized, represented and managed in the memory platform. They constitute the base of a lighter but more resilient form of process memory collaboratively generated.

The importance to build the design rationale collectively by the project participants is also proved by the results of tracing back the design rationale trough single storytelling experiences that we tested in SPP case study. We rebuild the planning process by a single story telling experience by one SPP planning team member. Afterward we presented the results of the representation of this single story telling in the memory platform to the ISF president and to one of the SPP project team member. The project team member was unaware of the process because she did not take part to it, while the president said it could perfectly recognize the phase of the project that she remembered in the map produced from the third participant

about the planning process. But when we entered in the details of one specific intervention (one design solution) she told me that:

"*This is just one of the history… there were much more and different facts and processes carried out by other people*"

One single interviewer is not aware of all the planning process. Other actors exerted key roles in the planning process and they had not been interviewed; lousing their contributions implies losing details and knowledge about the process. The impact of this lost grows as we deepen down to the specification and details of single design decisions.

Thereby we could conclude that the memory platform should be used in different way in different planning situations.

During the consultation meetings, in which we have the video as a base for the legitimacy for the knowledge reconstruction, the memory platform can be used as shown in SPP case. Memory system platform and its different tools offer a rich, transparent and clear representation of the planning process. On the contrary in order to use the memory platform to tell the design process of the planning team, this needs to be used from the planning team during the process, and it needs to be used directly by the team members. As reported in quotes from one of the key actors (Pd):

"…Well if we could have had one of these tools during the planning process this could have been of great value. In particular during the meetings with all the team members that we were organizing regularly to report the salient and relevant elements, facts, news of the work done up to that moment. Those coordination meetings could have been a good moment to monitor and capture relevant knowledge generated and exchanged between all team members…and also, in this way the knowledge traced by the process memory platform would have been uttered directly by the protagonists!"

Specific meetings and specific moments (such as moments in which a design decision is taken or coordination meetings, etc) need to be selected and represented within the memory platform by the meeting participants and in the on-going phase. This collaborative and on going tracing provide two major advantages:

- It gives a better quality of the knowledge gathered (because it comes directly form the knowledge source, that are the team member that are generating it during the process)
- It requires a minimal effort (because by tracing knowledge generation and exchange during the project we minimize the additional work that is needed to reconstruct the memory of the project post-hoc).

As suggested by the experience of 'Funes: the memorious' (see section 11.5.3), tracing all the process following actor by actor, meeting by meeting, detail by detail it is useless, it would cost too much efforts compared to the given advantages, and it can be even counterproductive. On the contrary, capturing and representing coordination meetings is a good way to trace the key ribbons of the history of the process. The history of one or even more then one single actor cannot be history of a collaborative process. Thereby in order to trace the design rationale the memory platform should be used on going and from who is working in the planning process. Noticeably this depends on the willingness of the planning team and of participants

to trace design rationale. There has to be intentional commitments to tell the story by the participants and by the planning team. This is an essential and binding condition to achieve any advantages from the use of the memory platform.

11.7 Representing Organizational Roles and Personal Information about the Stakeholders

The exploration of people roles proved to be relevant for the users during the experimentation process. In fact some of the users identified the key actors using as a criteria their organizational role. Many of the participants chose the representative of the organization that was higher in the hierarchy as default key actor, evidence that people are sensible and interested to the organizational role that stakeholders plays. Thereby this information needs to be more evident and clearly represented in the system interface.

On the contrary, as underlined by another domain expert, there is an ethical problem with the representation of personal information. Participants can consider that the memory platform represents in a very detailed way contents that she does not want to disclose.

Nonetheless evidence are given in SPP case that i.e. Community participants usually forget to be recorded, and act completely spontaneously, on the contrary politicians and bureaucrat usually do not forget they are recorded. They have a social image to protect so they would not forget it. In fact in regional and municipal meetings this problem doesn't exist because those are public meetings and each participants sign that all claims and video material can be used from anybody. The institutional rooms of the political decisions are nowadays completely transparent and disseminated. All the statements of the parliament are transcribed and diffused form local and national media. Thereby surprisingly it looks like institutionalized environments are the more appropriate to test and use these tools.

However we can envisage another trade off between what we gain by disclosing detailed personal information about the stakeholders in order to reveal power roles and asymmetry of powers in the planning process, and what we lose in term of privacy and anonymity of claims and preferences. The memory platform is first of all a tool to support inclusion and participation thereby the first objective is what we are aiming for. Nonetheless concerns about privacy problems needs to be taken into consideration especially when a memory platform is used to enlarge participation and knowledge contributions to all via the Web.

11.8 Orienting Knowledge Management to Action

We start from the base assumption that any kind of reasoning and reflection about both process and knowledge needs to consider several aspects of knowledge itself, which are highly context dependent (Ackermann '82). When this process is collaborative and knowledge intensive, like participatory planning processes are, the context is rapidly changing and deep reflections are needed in order: 1. to distinguish in the process between changing and resistant features, and 2. to interpret and make sense of what is happening. Observation, reflection and action often rely on personal participants' skills, in particular to their ability or practice to

carry out effective actions in rapidly changing contexts. We argue that ICT tools devoted to memory tracing can offer a valuable support to combine community skills with more systematic benefits coming from more structured process of memory exploration.

Memory building activities can bridge knowledge to action in two ways at least:

1) putting knowledge in multiple-contexts,

2) understanding the reasons for that context to be.

By performing these activities the Memory Support System would enable:

- better-informed actions, based on multiple-context explorations and cross-temporal comparisons with other cases (other knowledge applied to the same action, or other actions derived from the same knowledge);
- higher transparency and understanding of the scopes behind actions (exploring reasons behind decisions helps in understanding where the process is going and why, so that we can monitor and eventually change, on going, the process direction; this helps to better orient actions toward the goals of the actions themselves.

We designed a memory system focusing on the two points stated before: 1) we tried to represent knowledge in multiple contexts and 2) to trace the decisions rationale, that is to say explaining reasons behind decisions and actions. The current prototype is thus a multiple-knowledge repository, organized in content and context sub-repositories, in which every actor's statement can be explored according with its temporal, conceptual, spatial, social and causal-argumentative context. These multiple "views" on knowledge offer: i. a knowledge base for further analysis and evaluation ii. a detailed and multiple contextualisation of information and knowledge produced during the process and iii. the tracing of the decision rationale in form of argumentative chains explaining decisions.

11.9 Future Challenges and Research Questions to Address

Results of the evaluation studies are the knowledge base on which to build the answer to the last research question:

RQ7: What requirements should define the next design iteration of the memory platform?

Requirements for the next design iteration of the memory platform will be discussed in the following in form of new challenges and research questions to be addressed.

11.9.1 Enhancing Spatial Argumentation

One challenge regards the improvement and enrichment of the geographical information provided and managed by the memory platform. Planning problems invariably involve spatial issues and require spatial argumentation. Thereby the memory platform can be improved by enabling the interface with GIS systems. In this way the memory platform can handle the information formats that are

normally used in the technical planning practice. On this matter a significant open question needs to be addressed:

- How can we scale vague and abstract arguments to the precision provided and demanded by GIS systems?
- Is it necessary in order to analyze verbal argument such a detailed geographical information base?
- If yes, how can we face the problem of information exploration and use by non-experts?

GIS information requires a large quantity of data to be managed and manipulated, and this requires specific technical skills. These are additional skills that the planners need to have to manipulate the data and users need to learn to explore them. Thereby there is a trade off that need to be investigated. PPGIS is a relatively new and promising area of research in which these problems are investigated (Christina, Timothy et al. '04; Brenda '06; Kingston '07). Many PPGIS tools have been implemented to represent informal and abstract information on a GIS base (Renee '06). But much work needs to be done in order to understand how lay people claims can effectively be represented and then reused in the planning process.

11.9.2 Improving the Representation of Design Spaces.

The memory platform uses 2D representation of geographical areas to anchor claims and arguments to their spatial reference. These 2D representations are difficult to be understood and managed by lay people. As suggested by one of the experts interviewed in the evaluation phase:

"*A serious problem is that participants are not able to deal with technical drawings. So what I would like to see to improve the memory system is to view the spaces in 3D… so that it can be easier for them to visualize and recognize the spaces they are used to live in.*" Thereby a research question to address is:

How can we support participants in visualizing design spaces and engage them in participatory design experiences?

'Planning for real' as a research field is born as an approach to participatory planning that use models in order to make people express their selves as in real life settings (Gibson '91; Mitlin and Thompson '95). Particularly interesting are also the works in augmented reality explored in the field of human-computer interaction research in order to support participatory design with new way to imagine and visualize design spaces (Shen, Wu et al. '01; Underkoffler, Chak et al. '02; McCall, Wagner et al. '08).

11.9.3 Coping with the Growing Information Complexity

Another research line to investigate aims to address the problem discussed in section 11.5 of the growing information complexity. When the issue's maps becomes too big and the discussions too many and too complex new ways for searching and querying the memory system are needed.

One possible way to tackle this problem is by enhancing the memory platform with information retrieving algorithms. New methods and technology to enhance argumentative maps toward higher level of formality are being investigated at present and they show interesting results (Malone and Klein '07; Tzagarakis, Karousos et al. '07).

Another promising research direction to face the problem of the growing information complexity investigates new conception of the memory platform as knowledge-base system. The evaluation study showed that the memory platform is a power tool to analyze the planning process as social process. The memory platform describes social dynamics, organizational network, and people's claims shaping a rich information base on top of which it is possible to build complex reasoning. As suggested from one of the expert interviewee, that is an expert in decision theory:

"*In my opinion the memory system you presented follows a categorization of information that gives rich data about the deliberation process…and this data can be analyzed and manipulated in many different ways to support the decision-making process. But I think that so far you just worked with raw data, like geographical data, statements raised in the discussions…now on top of this you can build systems, like ontology-based systems for example, that can support complex queries about the deliberation process and that can help decision makers to reason with the huge amount of raw information and data you collected.*"

The knowledge taxonomy we proposed is a step toward the design an ontology to define the main knowledge fragments a collaborative process memory tool need to trace in order to effectively support collaborative project and collaborative decision making in participatory planning. The process memory system ontology can base on the description of the nature of the planning discourse and the classification of knowledge fragments that can be extracted form them that we proposed in the thesis. Then, the knowledge taxonomy provides the template for the knowledge fragments to be organized in a process memory schema so that they can be explored and reused. This is a first step toward a process memory ontology to support planning process analysis that follow the main knowledge fragment dimension envisaged in the thesis that are the social, argumentative, the spatial, the temporal and the project-goals oriented dimension. Such ontology would be the base to enable complex reasoning about participatory planning processes.

11.9.4 Defining a Methodology

Another possible approach to the problem is exploring new decision-making methods to couple with the use of the memory platform. Shaping the decision-making phases of the planning process can support the users of the memory platform and maximize the benefits of the use of the memory platform. Thereby looking at the three organizational level that the memory platform address the research question to investigate is:

What are the specific methods that the different users should follow to effectively explore and use the memory platform?

So far we tested the system usability in several case study and we proved that the users are able to engage with these new technology now the question is:

How they can be help to maximize the effect of their use of the memory platform in the real practice? Which methods they should use? How the use of the platform should change with the changing of meeting types, planning scale, project objectives, involved participants etc?

The memory system needs to be coupled with specific methods and techniques which can assist the users in better exploiting the memory system features and potentials.

11.9.5 Supporting Intentional Storytelling

As discussed in section 11.5.4 one of the main challenge to face is how to engage participants in tracing the design rationale. Research in participatory media looks particularly promising in order to explore new ways of engaging local community and lay people in collaborative works and storytelling experiences.

Novel appealing ways needs to be explored to attract participants to actively engage with the planning process, thus enhancing the trust of the community in the participatory process itself.

11.10 Concluding Thoughts: Not legitimation but Transparency and Explanation of Design Decisions

Any planning process generates non-trivial information and knowledge management challenges: even hierarchically managed, centralised projects already engage different stakeholders, span time and space, with many design iterations as vague requirements are gradually understood. The participatory turn in planning makes the process more complex in one sense, arguing for deeper engagement with institutional and non-institutional stakeholders in a collaborative process of deliberation, in order to build multiple views of problems and resources. Moreover, by definition, this process should itself be transparent, in order to earn trust that "participatory" is more than a reassuring label. The added complexity of opening up the design process is justified by arriving at better informed, more effective, more widely owned decisions.

This thesis has argued that at the heart of the matter is the intensely human process of people talking to each other. *Deliberation* — informal and formal, private and public, seeking common ground through dialogue, or seeking to prove you're right through argument and debate — is how planning happens. We have sought, therefore, to investigate to what extent we can realise a *discourse-centric* process memory software platform, by placing deliberation at the core of the information architecture.

A process memory platform has been proposed, implemented and evaluated to support deliberation tracing and to support reflection in and on planning actions. The applications we presented in the six case studies are examples of how the memory platform can be used to track, structure and represent deliberation phases within a planning process. We argued in chapter 4 why a process-oriented memory infrastructure could in principle address current limitations in participatory planning. The SPP case study (see chapter 9) provided authentic material to drive the design of the first version of the information architecture for the envisaged tool,

which was then implemented on top of the Compendium system as a visual hypermedia application with rich linking to support navigation within and between the five different dimensions of the memory space (see sections 3.4, 6.3.3 and 9.5)

We have shown how discussions and artefacts can be modelled as hypermedia networks to create a richly linked process memory indexed against the five dimensions of time, space, stakeholder, concepts/arguments and project structure (section9.6). Furthermore we have presented validation in terms of practitioner reactions in interviews (section 10.4) and empirical validation from hands-on usage of the prototype (section 10.3).

Results of our studies show that representing lay peoples' knowledge, scientific knowledge, political knowledge and social knowledge in the same process memory environment offers several advantages. These advantages have different positive effects at different organizational levels (political, technical and community level). The process memory platform can supports organizations in:

- making sense of the connections between issues,
- discovering new synergies and effective line of actions,
- understanding the effects of those actions,
- reflecting about possible alternatives, and
- informing decisions with a wider and transparent knowledge base.

We have reviewed the limitations of this work and considered how the system and the approach more broadly could be improved (section 11.5).

Emerging from this investigation we can identify a distinctive characteristic of the memory platform: *transparency*. The prototype memory platform tested in this work is distinct from other tools for planning in that it helps to make *deliberation* tangible — a central aspect of participatory planning that remains otherwise invisible. This introduces a new degree of transparency, unveiling responsibility and supporting the understanding of the reasons behind design decisions.

However, as Brian Fay discusses in *Critical Social Science: Liberation and Its Limits*, two constraints limit the power of rational discourse (or what we might term "reason") to produce transparent and accepted judgements:

"Reason cannot make human beings completely transparent to themselves or produce judgements which everyone must accept. Reason is limited because people are historically embedded within a network of countless relationships and because the narratives of persons depend on future events which are essentially indetermined."

(Fay, 1987)

Our reasons always depend on what we believe the other people thinks, on how we suppose they will act; and these considerations are founded on the trust we have in those people and on the experience of our living and sharing with them common spaces. This makes it impossible to be rational on building our "reasons" because these reasons will always be embedded in tangled and questionable relational networks. Moreover often events change the perceptions we have on people, relationships and environments, thus changing the base on which we found our reasons. On the light of these thoughts, capturing one person's current reasoning does not imply capturing what her reason will be, also in a near future. These two problems make it difficult to define and defend planning decisions both from the

judgements of people and from the test of future events. Nonetheless rational explanations of actions and decisions are the only practical defence a planner can use both to legitimate his work and respect the right of other people to make judgements. Even though narratives can change not only basing on future events but even on personal attitude and believes the narrative of the design should be clear to the designer and disclosed to the audit that will be affect form the design.

Tracing the design rationale doesn't aims at producing *judgements which everyone must accept*, but aims at explaining the reasons behind design decisions, contextualizing them to the *historical network of people and relationships* in which the design developed, to the knowledge used, and the environmental and social context in which it developed.

Although, according to this view, design history can never be immune from future interpretations, a process memory platform making design deliberations and decision rationale transparent to the public offers two responses:

- providing this trace exercises the responsibility of planners to justify their work in a publicly inspectable form;
- providing this trace in an intelligible user interface gives others the possibility to build their own alternative and even conflicting narratives.

The memory platform proposed in this thesis is a first effort to model planning processes as social, dialogical processes. While the software has elicited encouraging reactions from diverse stakeholders, an open issue remains: *Is the planning culture ready for transparency of the sort envisioned and demonstrated by this work?*

Institutionalized environments are often still hostile places to innovation and change. As the first interviewee acknowledged:

"…If we talk about political and administrative class, I have to admit that those environments are very resistant to change. It could be really difficult to introduce any kind of innovation in the administrative process. There is a cultural resistance to innovation. On the other hand, politicians consider dangerous everything that could fret or undermine unilateral decision. The status quo is always defended from the political class against anything that could undermine the current decisional power."

There is no great revelation in this view, although it is a sobering reminder. The question is how the shift to greater openness be accelerated? We might conclude that cultural change toward citizen inclusion and participation to planning and policy decisions need to take place *before* these technologies and methodologies can exert any real influence on planning practices. Planners first need to abandon preconceptions about participatory planning practice. The four different paradigms in planning need to be artfully woven together: planning as technical process, the creativity of the architectural design, the social implications of policy making, and collective intelligence/community wisdom.

However, such change is precipitated by building demand for new ways of working, as a critical mass of opinion builds around new visions of what is possible. We might conclude by reflecting on the contrast between revolution and evolution. The introduction of disruptive Web 2.0 social networking tools with self-organising user communities has had radical democratising impacts in certain sectors (e.g. news media; political election campaigns; product reviews). It is possible that

militant communities might mobilise with such tools to democratise and open up what was intended by authorities to be a centralised planning process.

However, surely an even better approach that avoids the need for such a 'revolution' is the willing co-evolution by planning practitioners of their own practices. Our goal has been to model, deploy and reflect on one vision of what this might look like. Hypermedia discourse technologies for social interaction and lightweight information structuring provide novel opportunities for participatory planning. Diverse forms of knowledge from multiple stakeholders can be mapped within a common, multidimensional information architecture. With a willingness on the part of planners to construct the 'intentional stories' that can serve as meaningful design rationale, new levels of transparency and accountability in decision-making are possible as deliberation processes become tangible networks connecting key ideas, arguments and information fragments.

Appendices

Appendix 1: Final Coding Schema

pre-exploring the system

Pre-reading the questionnaire

Reading and Answering quesiton by question

Exploration Actions

Follow links direction when reading the map

Open a view from the numbers in the list nodes

open a view from the right number menu

Play video

Random clicking
the actor click on divverent views/nodes in order to find information but wthout having ay
clue of where to search. He is disoriented

Read/follow links label

Reasoning about the contetns using system features

Recognize node types

Understanding knowledge structuring in the system

Use the right number menu

Explored views

Actors' view

Cartographic references view

Consultation meeting decisions view

Decisions of the first meeting

Design Ratinale view

fifth discussion

First discussion view

Fourth discussion

Home view

Instiurions representatives

ISF group

List of Statements

Meetings contents view

Planning team

Problems list

Project Proposal list

Questioinnaire

Random clicking

Second discussion view

Single stakeholder node

Spatial argumentation map

Spatial view - Localize the discussion

SPP community view

Stakeholder general info

synthetic view

Temporal view

The hystory of the Neighbourhood

Third discussion

View "SPPmem what is it?"

View: How to navigate into the system"

View: Hystory of the meetings

Events

P. get stucked

P. understand and overcome the bolck helped from the R.

P. understand correctly and overcome the block by himself

User-researcher dialogue

Participant answers

This code refers to users answers to specific questionsraised form the researcher

Participant confirm he understood/agrree

Participant suggestion/POV

Participant's question/doubt ON THE QUESTIONNAIRE/TASK

Participant's questions/doubt ON THE SYSTEM

Research ask for clarifications

Researcher answer

Researcher questions about the questionnaire interpretation

Researcher questions about the system

Researcher's suggestions
This code refers to moemnts in which the users get stucked and then the researcher cosider
usefull to give him some info o suggestion to proceed

Impression from the Researcher

P. consider the system feature fuorviating

P. consider the task almost IMPOSSIBLE

P. considers contetns are not compleate

P. Looks confused

Problems and Suggestions stated form Participants

Conflicting or double direction arrows

difficulty in understanding and using the left and right numbers

discrtionality in categorization

Inproving representatoin of links and underlining betterconflicts and proposals

Missing contetns: Contetns are not compleate updates, didn't follow the c. evolution

node icons too small and similar to each other

Numbers in the list are useless and misleading

pictures and maps as node images

poject area need to be locate into a wider geografical framework

Represent one info with the same visual mean: always list of always node

Spatial view not effective and compleate

Syntetic view is esxtremely important

temporal view describing process evolution

The theme of discussion and the starting question in not clear

too many way to reach the same informations makes difficult to memorize

understanding IBIS icons meaning- a legend could be add to each view

Software features recognized and claimed from participants

Consensus building

discovering commmunity-knowledge

Extract directions to solve design problems

Extract knowedge from discussions

focus on relevant issues that otherwise could be dispersed in the consultation proces

Follow single actor reflections

for institutions: to know community need so that these can be adresses with project

Frame single actors way of reasoning

I support the work linking new data to any reference or data, reducing paper artifact

It is a thcnical tool for practitioner

knowledge structure: organization of information by categories

legitimate solutions

Mapping discussion

organazing and ordering between raised issues

Possibility to refer discussions ro any kind of reference

ready retrieving of information

ready- consultation/exploration

Representing spatial discussions

support community to discover their local identity

Support discussion undestanding trought IBIS icons

support to explain the LOGIC behing solutions/decisions

the sinthetic view is useful to sintetize what happened and then to explore destails

Useful to identify conflictual points

Widening community participation to problem definition

Encountered Usability problems

don' understand node type

don't follow question-answer nodes interpretation

Don't read links' label

don't see some nodes

Don't see the left down number

Isolated nodes

Key words used with double meaning

Opening/Closing nodes

Problem with arrows' orientation

Appendix 2: CoPe_it! Evaluation Questionnaire

CoPe_it! evaluation questionnaire

This questionnaire has the aim to evaluate the usefulness and easy of use of Cope_it!, referring to the on line discussion you have been involved in.

The questionnaire has three parts the first two are divided by objective of evaluation (Perceived Usefulness, Perceived Easy of Use) and they require your answer to be in a fixed range of values. You are also kindly requested to motivate your answer. The last part refers to open questions you can decide to answer freely indicating point of views and suggestions.

Part 1. Perceived Usefulness (PU)

Choose between these ranges of values (Absolutely Yes - Yes – Neutral - No - Absolutely No) the answer to the following questions.

Please try to give arguments for your answers (motivate the choice)

1) Do you think the software helps to organizes the discussion efficiently

2) Do you think it is easy to learn?

3) Do you think it is easy to use?

4) Did you enjoy using the software?

5) Do you think you would like to use it again?

Part 2. Perceived Easy of Use (PEU)

Choose between these ranges of values (Yes – neutral - No) the answer to the following questions.

Please try to give arguments for your answers (motivate the choice)

1) It is easy to find out the available options?

2) The functions, menus and icons are easy to understand?

3) The interfaces are easy to read and use?

4) The content is easily understandable?

5) What you had achieved was clear?

6) What you had to do was clear?

Part 3. Open questions

Please answer freely to the following open questions

1) What, if any, helped you in understanding better how to understand and use the tool?

2) Can you say, if any, the main advantages you see in using the tool?

3) Can you say, if any, the main limits of the tool?

4) Where you able to express all the contents you need to express in your discussion?

5) How long it took to learn the main functionalities of the system? (Please try to quantify in terms of: hours, days etc)

6) How long it took to start to use the tool properly? (Please try to quantify in terms of: hours, days etc)

7) Which are the main obstacles, if any, you encountered in learning and using the system?

8) Do you imagine, if any, possible ways to overcome these obstacles?

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