Groupware and Public Participation for Urban Planning[1]

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During the last decades, computers were mainly used for designing urban maps and storing appropriate data for urban management clerical works and to a lesser extent, for spatial analysis. But now, by means of the Internet, computer-supported co-operative works (CSCW) can be easily organised (Gronbaek et al. 1993, Malhing et al. 1995, Palmer et al. 1994, etc.). Know also as groupware those new techniques allow several persons, located in different places, to work together. This new mode of working appears very appealing for urban planners, especially for designing and assessing alternatives. One very important aspect is the use of GIS for public participation, especially facing new urban projects, but right now, few computer tools were provided to this key-issue.

The scope of this paper will be to give the main elements of groupware in general, and in particular dedicated to urban planning. After some definitions, we will examine carefully the consequences on the work of urban planners. Similar new computer tools for public participation will be presented. To conclude this paper, we will give some methods to store arguments and opinions, especially coming from citizens.

1 WHAT IS GROUPWARE?

Under different names such as groupware, CSCW (Computer-Supported Collaborative Work) and participatory design, new techniques are presently emerging allowing different people to work together for a very precise target with the assistance of computers. Indeed, the paramount majority of existing computer tools are devoted to single users, or when dedicated to several users, the design of such cooperative systems are much more complex. Indeed, the main reason is because people supposedly working together, are not located at the same place and not working at the same time, whereas clerical processes should be carried out within scheduled time.

Urban planning is a task involving several users to collaborate in order to design a plan including map and written statements. Up to now, computers were overall used for cartographic purposes or as databases (Laurini-Thompson, 1992) and it could be an important challenge to offer urban planners a CSCW system in order that the participatory design of urban plans can be performed (Laurini, 1995). The goal of this section will be to define the potentialities of those new techniques for urban planning and especially for land use planning.

This first section will be devoted to the definitions of concepts of groupware and of connected techniques. Then we will try to summarize the benefits and limitations in order to conclude this section by presenting some elements in software architecture for cooperative information systems.

1.1 Definitions

According to DE Coleman[2] (1995), "Groupware is an umbrella term for the technologies that support person-to-person collaboration; groupware can be anything from email to electronic meeting systems to workflow". But in reality, there are many other definitions of groupware. According to Nunamaker, Briggs and Mittleman (1995), groupware is defined as "any technology specifically used to make group morproductive". In Table 1 several technologies that fall under the groupware umbrella can be found. Besides supporting information access to several persons, groupware can radically change the dynamics of group interactions by improving communications, by structuring and focusing on problem-solving efforts, and by establishing and maintaining an alignment between personal and group goals.

Groupware is...	
Computer Supported Cooperative Work (CSCW)	Team Database
Group Decision Support System (GDSS)	E-Mail
Group Support Systems (GSS)	Project Management
Coordination Software	Group Conferencing
Group Memory	Video Teleconferencing
Information Filtering	Electronic Brainstorming
Electronic Conferencing	Shared Drawing
Groupware	Electronic Meeting Systems
Group Scheduling	Workflow Automation
Team Calendar	Electronic Voting
Group Development Tools	Shared Edition

Table 1. Several definitions of Groupware and related issues, according to Nunamaker, Briggs and Mittleman (1995)

According to Turban-Aronson (1998 p 319), the major benefits of video-teleconferencing are:

- providing opportunity for face-to-face communication for people in different locations, thus saving travel time and expenses,
- enabling several members to communicate simultaneously,
- providing the possibility of using several types of computer media to support conferencing,
- enabling usage of voice (which is more natural than using keyboards).

[1] This paper is an excerpt of chapters 8 and 9 of my book "*Information Systems for Urban Planning, A Hypermedia Co-operative Approach*", Taylor and Francis, February 2001. See http://lisi.insa-lyon.fr/~laurini/isup for details.

[2] Be careful, there are two David Colemans working in this area, one in California, USA (David E. Coleman) and one in New Brunswick, Canada (David J. Coleman).

More precisely, for our concern, four categories of grouping aimed at greater productivity can be distinguished:

- **group calendering and scheduling** to automate the process of setting up the meeting and the collaboration,
- **electronic meeting support systems** to increase meeting output, productivity, and the quality of decisions,
- **group project management software** for meeting follow-up,
- **workflow software** to route and track documents and action items generated from the meeting and other events.

As seen in the previous definitions between users, one of the main objective is not only to make people working together, but overall to provide them tools in order to make them more productive, that is to say first of all that the quality of communications between people should be enhanced.

In order to ameliorate the discussions, several sophisticated tools have been provided such as computer-based conferencing, electronic meeting rooms, etc.

1.2 Participatory design

In several applications, the objective is that people should design something cooperatively. For instance, several kinds of engineers are involved in the design of cars, planes, bridges, buildings. In this case, not only communications must be enhanced, but also the software has to provide specific tools in order that at each step of the design, every involved member should do his work soundly.

In order to reach this goal, a database storing several versions of the design, and also of the interactions between all engineers must be created. Here we have to address the problems of the storing items of design at different steps and of different versions.

1.3 Benefits and limitations

According to Coleman (1995), among the benefits one can find:

- increased productivity,
- better customer service,
- fewer meetings,
- automating routine procedure,
- integration of geographically disparate teams,
- better coordination globally,
- leveraging professional expertise.

But there exist some limitations of these techniques:

- there is a too low level of education in the business community about groupware,
- organizations are resistant to change,
- there are few standards in the groupware market.

1.4 Cooperative information systems

Under the name of cooperative information systems, one defines a database storing all information and knowledge necessary to support the collective work. Generally speaking, it consists of a distributed database system with one central database and several local databases. Whereas the local databases store information necessary for end-users, the central database goal is to store common information for the global project management.

As exemplified in Figure 1, the distributed and cooperative information system is linked to a first system for task and message management and a second for participatory design.

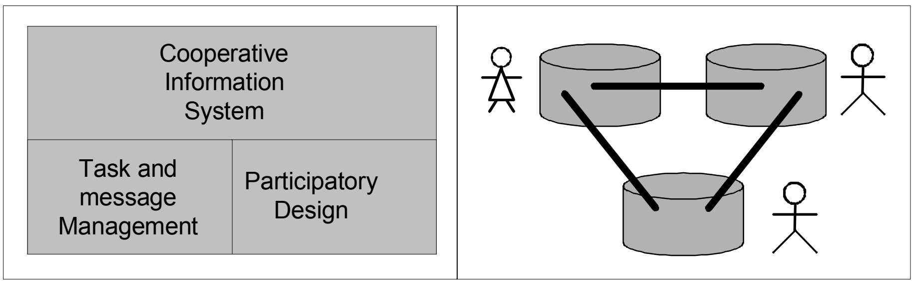

Figure 1. Structure of a cooperative information system.

An important way to classify the different systems is the possibility for users to be at different places and/or at different times. Of course, when everybody meets at the same place, this is simpler, but in other cases, social interaction needs more complex computer-based systems. Johansen et al. (1996) defines four possibilities according to the time and the place and gives several examples. And Table 2 lists some classes of computer tools which enter into these options.

1.5 Group decision support system (GDSS)

Important characteristics of a GDSS may be summarized as follows (Turban-Aronson p 353):

- a GDSS is designed with the goal of supporting groups of decision-makers in their work; as a consequence the GDSS should improve the decision-making process or the outcomes of groups;
- a GDSS is easy to learn and to use. It accommodates users with varying levels of knowledge regarding computing and decision support;

- the GDSS is designed to encourage activities such as idea generation, conflict resolution, and freedom of expression.

OPTIONS	(a) For different place / different time	(b) For different place / same time	(c) For same place / same time
1. Ad-hoc information exchange (very short)	. Fax . Email general, or with information filtering and conversation structuring	. Telephone . Cellular Phone . Videophone	
2. Group meeting / presentation / teaching (few hours)		. Video-conferencing systems . Audio-conferencing systems	. Group Decision Room (GDR) equipment . Presentation equipment
3. Teamwork (long time) (including 1, 2 and 4)	"*Keepers*" . Computer-conferencing . Co-editing system . Group-CAD systems . Other sharing systems "*Synchronizers*" . Group-calendar . Shared project planning . Shared workflow system	. Video-conferencing systems . Audio-conferencing systems . Screensharing	. GDR equipment
4. Socializing		. Media spaces	

Table 3. Social interaction supporting systems

GROUPWARE AND URBAN PLANNING

After having described some of the characteristics of groupware and CSCW, it is now important to answer the question of its relevancy for urban design and planning. Facing the importance of the task, the American National Center for Geographic Information and Analysis (NCGIA[3]) has created the initiative #17 on Collaborative Spatial Decision-Making, but with a broader sense than urban planning. For details, refer to the Scientific Report edited by Densham, Armstrong and Kemp (1995). Concerning urban planning, let us quote also the works of Shiffer (1992, 1995) in the US and those of Maurer and Pews (1996) in Germany.

In this section, we will first describe as an example of what could be done, the French planning design process, the actors and their roles, the conditions of success of integrating groupware into urban planning practice in order to evaluate how groupware can be a relevant tool for enhancing those practices. We will finish by the presentation of some systems.

1.6 Description of the French planning process

The French planning process is a very complex machinery involving several actors. In Figure 2, all the official steps of the planning process for a French city are mentioned together with the actors and the juridical actions, and some juridical deadlines. In fact in steps such as "*Blueprint design*" and "*Possible Modifications*", the staff of the Planning Agency and of other governmental offices are the main hidden actors whereas the Lord Mayor with the Local Council are the main visible actors.

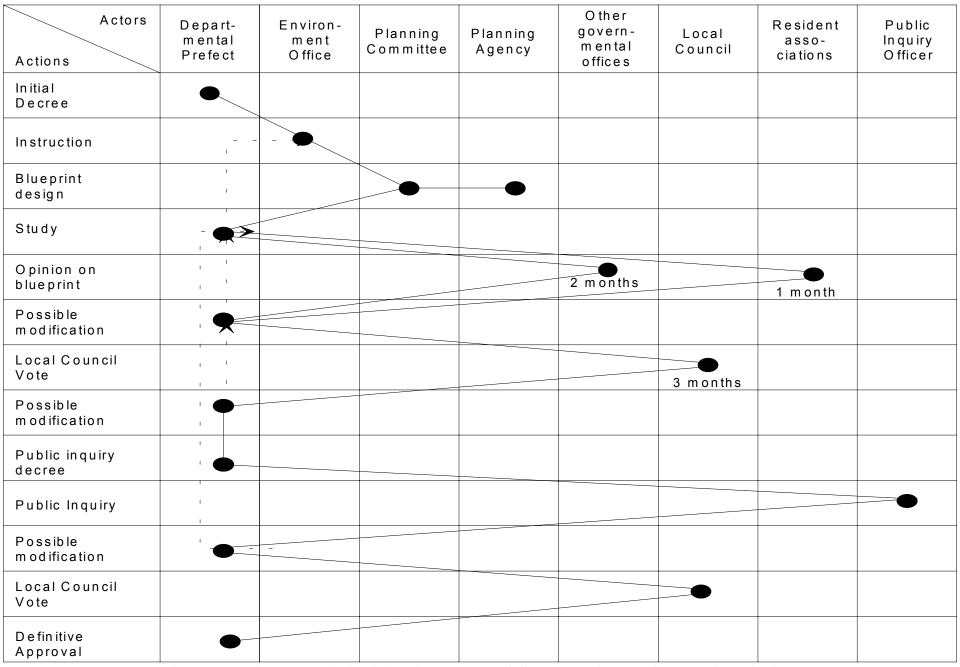

Figure 2. The French juridical process of the French Land Use Plan design

In other words, this Figure 2 shows the routes that map and written documents must follow in order that the Plan will be approved and applied (Laurini, 1980, 1982).

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3 University of California at Santa Barbara.

It is necessary to mention that this procedure can last from several months to a few years. In several cases, for some minor projects for instance the renewal of a small city ward or the building of a bridge, the procedure is shorter even if the actors and the actions are more or less similar.

Differently said, the plan evolves from version to version or alternatives. In order to get a new version, in addition to the differences in map and written statements, it is necessary to store all information in order to know the reasons for this new version (Figure 3). Some reasons may be technical such as arguments; technical advices and simulation results, and some other may be more political such as citizens' opinions, elected politicians' votes or vetoes, and so on. In some cases, a new version may not be the child of a single previous version, but the argumented amalgamation of several previous versions.

1.7 Actors and roles in urban planning

In the planning process, we can consider that there exist three types of actors, technicians, politicians and citizens.

- By **politicians**, we mean in the narrow sense elected politicians in charge of urban planning, because they are the real decision-makers regarding the future of their city, and in the wide sense, all members of the City Council who vote for deciding about the plan.
- By **technicians**, we mean all staff either working in Urban Planning Agencies or in the Engineering Services of municipalities or more generally of local authorities. They can be consider as advisers of elected politicians. They can use computers very widely in order to draw map, to execute simulations, to write drafts of written statements and so on.
- In addition to isolated **citizens**, we must count the representatives of some urban groups (city-dwellers' associations, etc.); those persons are generally asked to give their opinions at the beginning of the process, but overall they have to participate in the public consultation (public inquiry).

In general, groupware systems for urban planning must be addressed to technicians during their daily work, but also for the elected politicians for key-decisions and definitively during city council plenary meetings.

More precisely, as given in Table 3, depending of actors, a groupware system can have different utilizations. For instance, it will be used extensively all day long by municipal engineers and architects, but only a few times by the Departmental Prefect or the city councilors.

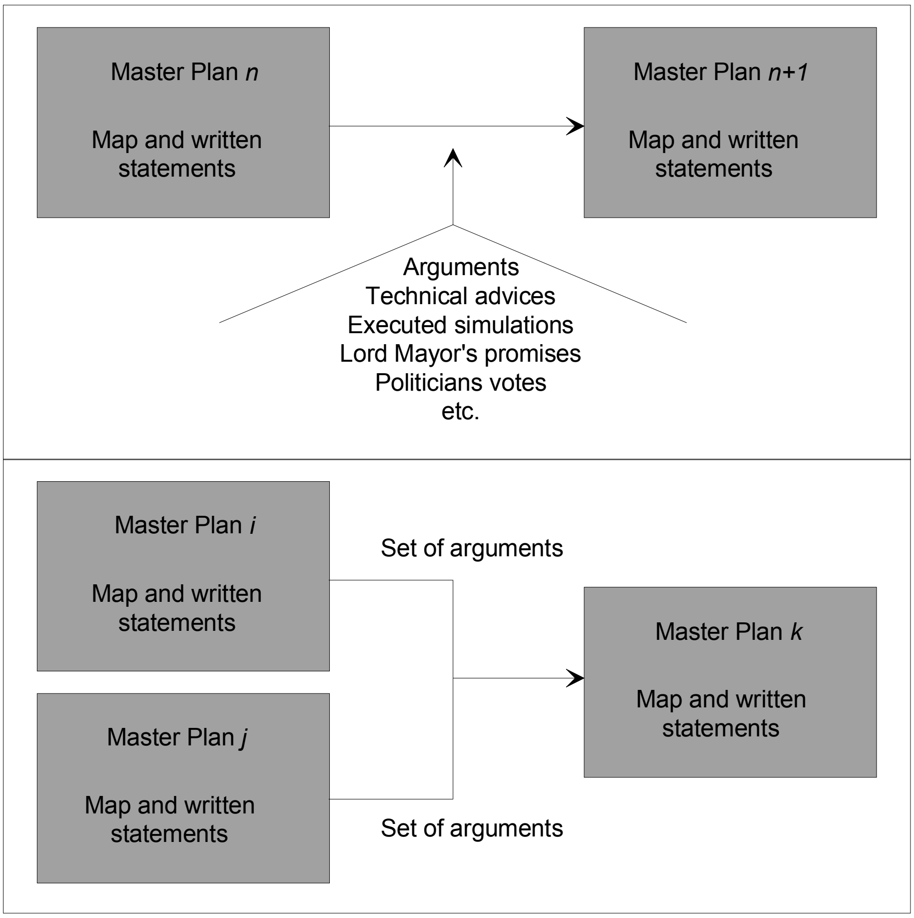


Figure 3. Information necessary to support new versions of plan.

For all those actors daily working with such a system, e.g. especially urban planners and municipal engineers, in order to follow the processing of the plan, several messages must be sent overall regarding the actions to be performed. By roles, we mean the different functions that an actor must have during the planning process (possibly one for the majority of them). By proxies, we mean the possible delegation an actor can give to another actor especially when the former is absent in order to speed up the whole process, overall for minor decisions or actions.

Actors in Urban Planning	Groupware in action	
	Frequency	**Type of usage**
Higher planning officer	From time to time, (minimum once a month)	General checking, Final approval
City councilors in charge of urban planning	Several times a week	Requirements Meetings Simulation Votes
Other city councillors	Several times a month	Checking, Votes Conferencing Meetings
City dwellers associations	At the beginning and during all the process, especially during inquiry	Desire collection
Public consultation	At the end, daily, one month long	Photo-realistic visualizations Simulation Opinions
Urban planning staff and Municipal engineers and architects	Daily, during the whole process	Simulations, cartography Meetings, Authoring, Messaging, Conferencing

Table 3. What groupware can afford to the main actors of urban planning?

1.8 Conditions of success

After having very rapidly described the key-elements of a groupware system for urban planning, it appears important to examine the conditions of success of such a tool. Among those, let us examine few of them.

a/ will of participation

As a first key-elements, it seems that the will to organize urban planning work with such a tool is very important, not especially for all involved decision-makers, but also for technicians.

b/ training

One of the apparent drawback is that several urban planners are computer-illiterate, so they can resist to the change. In other words, training them in using computers will be of paramount importance.

c/ well-designed CSCW system infrastructures

Even so the CSCW product is well designed, it is important to have first reliable computing network and computers. In this category, we can also mention a very good quality urban database not only for census and alphanumerical data, but also for cartographic information. The coupling of a Geographic Information System and of a groupware system must be very efficient.

According to DE Coleman (1995) the equation of success for groupware is:

Groupware Success = Technology + Culture + Economics + Politics

As far urban planning is concerned, personally, I do think that the conditions of success are more or less the same as previously described.

1.9 Groupware in action

Suppose that a groupware system is installed within some local authority, the essential role will be the definition of the plan (map and written statements) for which different states can be defined. In order to fulfil this task, several versions of the plan must be considered. In other words, a graph of versions or alternatives can be defined starting from for instance the Old Master Plan to obtain the New Master Plan.

In reality, two kinds of versions must be distinguished, proposals coming from the staff such as intermediate versions and versions duly approved by a vote of decision-makers as exemplified in Figure 4.

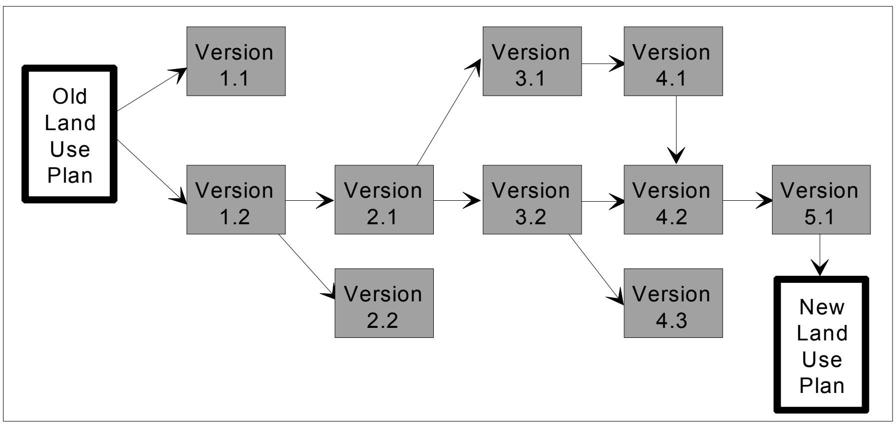


Figure 4. During the planning process, the Land Use Plan evolves through several versions until to reach the final state, that is the approved new Land Use Plan.

When a modification of a version is suggested (Δ V), the concerned advisers will examine it both at technical and juridical levels (Figure 5). In some cases, financial consequences must also be evaluated especially for investments costs and returned taxes. If the suggestion is not accepted, perhaps some modifications can occur until a coordinator will either approve it or makes some arbitration. Finally, the suggestion is proposed to voters (elected politicians of the City Council) who can accept or refuse it.

Each zone can have a different way of processing routes: indeed, in some parts of the city, the agreement can be very easily reached, but in other precincts some difficulties or conflicts can occur. In other words, some states must be conferred to zones. But the geometry of those zones can vary along time. A sort of spatial automaton must be defined in order that each zone can follow the whole process until the final approval. And during the plan-making process, some zones can be split or some other zones can be amalgamated.

Sometimes a zone under study must be split into several smaller zones and different plans can be designed for those smaller zones. In Figure 6, a city was split into three zones, each of them being assigned several plans: the A zone has three different plans, the B zone two, and the C zone three. Those different plans must be considered as different versions. Some of them are used to design new versions and some will no more be used to design new versions. When two versions of neighboring zones are accepted they can be fusionned to give an amalgamated version.

By amalgamated versions, we do not mean only the carbon-copy of the versions of the neighboring zones, but also the necessity to fire some consistency tests at the boundary. To get the final version all zonal versions will be amalgamated after several consistency tests.

1.10 Towards systems for spatial negotiation

One of the main characteristics of a groupware system for urban planning will be to offer actors the possibility to reach some certain level of consensus. For each of them, all versions must be evaluated, not only along certain criteria, but also some simulation tools to estimate the possible consequences. Whatsoever are the actors and their criteria, a spatial negotiation system must be offered to them. By spatial negotiation tools, we intend that some support will be offered to actors so that some level of agreements can be found. Such a system must take into consideration:

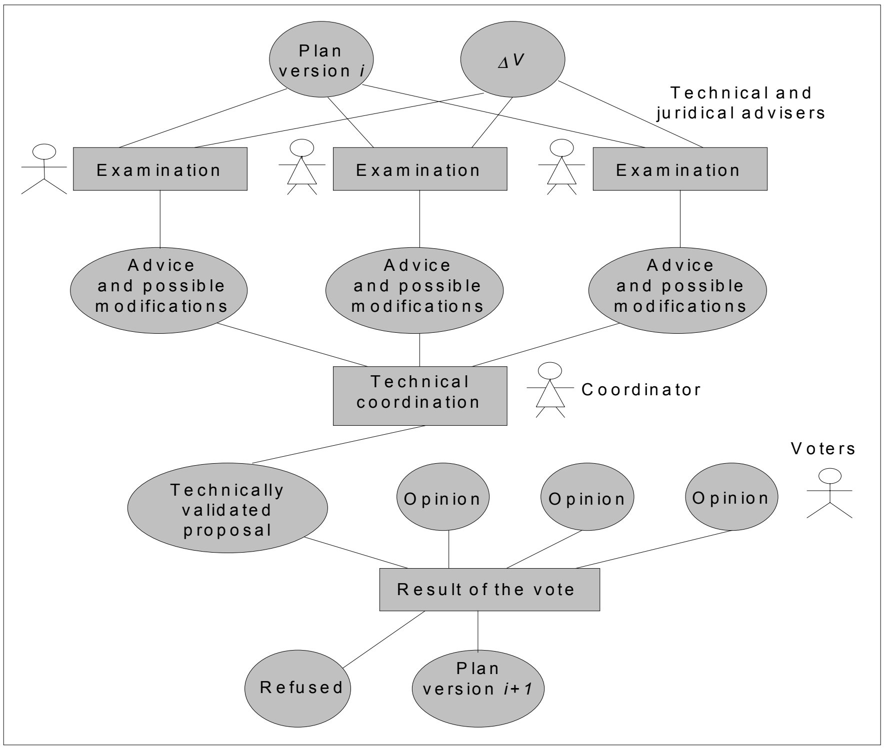


Figure 5. Each modification of the version (Δ V) needs to be examined by technical advisers in order to verify the technical and juridical aspects.

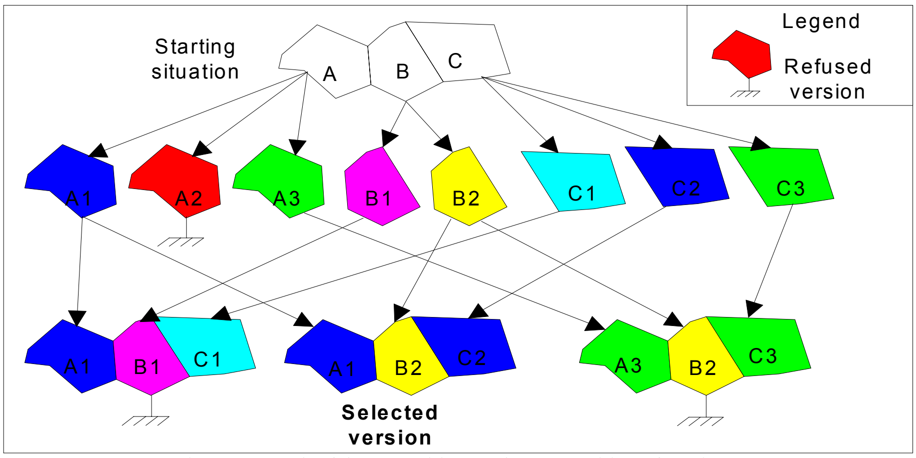


Figure 6. Graph of decomposition, and recomposition of versions.

- the city and its current environment,
- the version of plan and written statement under study,
- the simulated consequences from different points of view,
- the known actor's public criteria at global level together with their evaluation,
- possibly some other aspects.
- etc.

It seems important to mention that some (maybe all !) actors can have private criteria. Evaluations of those private criteria must be made at local level, i.e. on private or local computers, and the evaluation of such criteria must be let at local level.

Anyway, an actor called the facilitator must propose some consensus to the concerned actors. Each of them must evaluate this proposals and give his/her agreement. When not all actors agree, perhaps the facilitator can impose a solution; let us call arbitration this situation in which a consensus is imposed either by the facilitator or by the dominant actor.

FROM GROUPWARE TO PUBLIC PARTICIPATION

As a transition, let us say that cooperative work and participatory design supported by computers are new techniques which can be applied to urban planning. Due to the specificities of the plan-making process involving several actors and dealing with zones of different states of processing, some particular techniques must be considered. And in this paper, emphasis was overall given on the necessity to consider such a system as a spatial negotiation system with version management.

However, beside technical problems, one of the main difficulties remain in the acceptation of such a groupware system by all people acting in the planning process, especially by elected officials.

Due to the special architecture and also the fact that urban planners can have difficulties to give complete requirements of such a system, it is also important, before implementing such a tool, to discover all the characteristics, and to make some preliminary prototypes.

Maybe, other difficulties can occur when trying to connect some geographic information system to a groupware system in order to examine what are the other technical difficulties.

Eventually, I am confident enough to think that such tools will be existing and in use in the next decade.

But, one of the key aspects of urban planning is **public participation**. The ways of citizens are involved in urban planning can vary a lot from countries. Even if the number of existing experiments is very limited, I think of a paramount importance in a modern democracy to offer city-dwellers some tools for at maximum designing, or at the minimum to be fully aware about what their future urban environment will be.

In order to reach those ideals, among the problems to solve, let us mention

- **participative plan design**, that is to say the way of involving citizens in the design of local plans; one of the possibility is the debate concerning environmental and urban planning;
- **urban plan visualization**: the way to present urban plans, not only map statements, but also written statements. Apparently map statements look easier to be understood, but studies have showed that a lot of people do not understand maps, especially when the contents bear some prescriptive juridical aspects. A direction of research can be the visualization of urban plans in order to be understood by lay-people. Perhaps some combination of animated photos will help together with hypermaps systems.
- **opinion collection and synthesis**: some people can give their opinions, or different remarks regarding the proposed plans (Laurini 1982). What kind of visual computer languages to offer them, especially in order to precise modifications of alternatives? What kinds of mechanism to provide for synthesizing those opinions? The existing citizen forums provide an interesting solution to this issue.
- **information distribution and communication between citizens and the city council**: for this task, Internet can be used as a medium for exchanging information, ideas, maps between all actors.
- **facilities organizations**: in order that scores of people with limited knowledge in computing can also participate by understanding plans, reading maps and written statements, giving their opinions and playing with urban virtual reality, the arrangement of the premises must be carefully studied.

In some cases, the expression "*Public Participation Geographic Information System*" (PPGIS was used by several authors (Nyerges-Barndt-Brooks 1997, or Jankowski 1998)) But, as we will see, we are long from a conventional GIS; and the expression "*Computer System for Public Participation*" looks more appropriate in this context.

In this domain, we need to distinguish a very common character in the domain of public participation, named NIMBY (Not in my backyard !) representing people defending only their own property, often very aggresive in environmental dispute, and using general interest to protect their private interests. Sometimes, they "pollute" the debate.

So the goal of this section will be to help planners in the design of new computer systems for involving citizens in the urban planning debate. First, the objectives of such a system will be clarified. Then the specifications will be launched, giving an importance to debate modeling. And finally, some existing systems will be described.

OBJECTIVES FOR PUBLIC PARTICIPATION AND DIFFERENT WAYS OF INVOLVING CITIZENS

According to Craig (1998) organizing public participation in a city can have the following objectives:

- **expand the public's role** in defining questions and making decisions in which location or geography have a bearing on the issues addressed;
- **increase public participation** in the identification, creation, use and presentation of relevant information in various problem solving contexts; and,

- **enable wider public involvement** of stakeholders in planning, dispute resolution and decision-making environments through a computer-based public participation process.

More practically, the public can be involved for the following collaborative planning processes such as public dispute resolution, facility siting/design review, futures and scenario planning. Different media can be used to involve people and an interesting classification was made by Vindasius in 1974, quoted by Sarjakoski, 1998. See Table 4.

According to Schuler (1996), in order to be efficient, the characteristics of a public participation process should be:

- **community-based**, that is to say that everyone in the whole community/city should be involved;
- **reciprocal**, i.e. any potential "consumer of information" should be a producer as well;
- **contribution-based**, because forums are based on contributions of participants
- **unrestricted**, i.e. anyone can offer his participation
- **accessible and inexpensive**, that is to say that the use of the system must be free of charge to everyone;
- **modifiable**, because the legislative framework, the planning systems and the software can evolve, and those evolutions must be taken easily into account.

1.11 From Arnstein ladder to Kingston ladder

The problem of the various degree of involving people in landuse planning is very old. In 1969, Arnstein proposed the first ladder for public participation with eight steps, manipulation, therapy, informing, consultation, placation, partnership, power delegation and citizen control. But this ladder was not seen adequate. Sarting from a previous work made by Weidemann-Femers some years before, Kingston (1998a) has proposed a six-step ladder (Figure 7) which appears more relevant for our purpose. Among the steps, one can successively find from bottom to top (the lower steps meaning no real public participation):

- **Public right to know**: in this first level phase, the public has only the possibility to be aware that some planning issue could be of interest;
- **Informing the public**: here the concerned local authority implements some action plan in order to inform the people; but the people has no possibility to react;
- **Public right to object**: here the city-dwellers may say yes or no to a project, but have no possibility to react neither to amend it;
- **Public participation in defining interests, actors and determining agenda**: this is the very first level of participation;
- **Public participation in assessing consequences and recommending solutions**: now the public is truly involved in analysing the impacts of possible decisions and can recommend solutions which can be accepted to be implemented;
- **Public participation in final decision**: this is real participation in the final decision; the decision is not only made by elected officers (city-councilors for instance), but each citizen can vote whether or not to accept the plan.

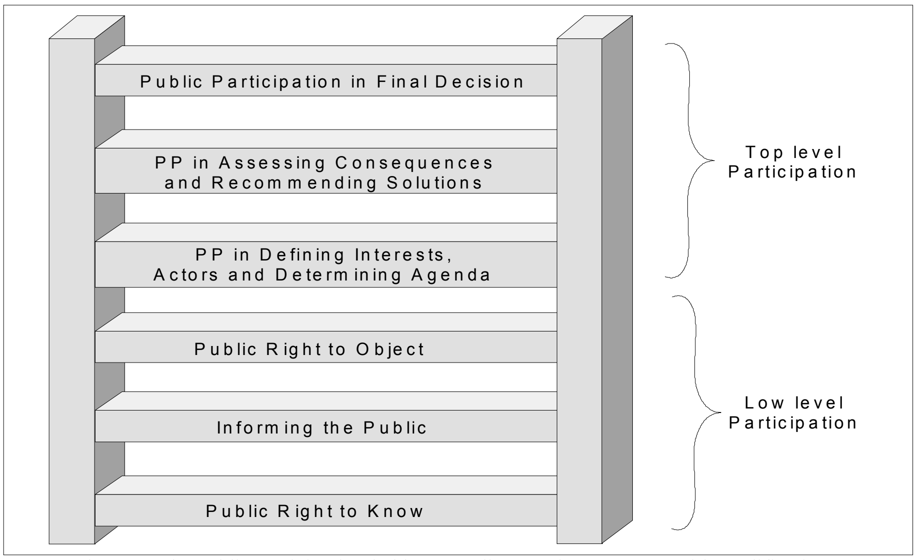


Figure 7. The public participation ladder according to Kingston 1998 with modifications.

1.12 Vindasius classification

In 1974, Vindasius (quoted by Sarjakoski, 1998) proposed a classification of the type of mechanism to involve people in planning (See Table 4). For each of those types, a sort of scale is given trying to valuate the foci in scope, specificity, communications and so on.

FIRST SPECIFICATIONS OF AN INFORMATION SYSTEM FOR PUBLIC PARTICIPATION

Now that we have clearer ideas regarding the objectives of a computer system for public participation in urban planning, it could be possible to elaborate the specifications.

Type of public involvement mechanism (Vindasius, 1974)	Descriptive dimensions				
	Focus in scope	Focus in specificity	Degree of two-way communications	Level of public activity required	Agency staff time requirements
Informal local contacts	*	***	***	**	**
Mass media (newspapers, radio, TV)	***	*	*	*	*
Publications	***	**	*	*	**
Surveys, questionnaires	**	***	*	**	**
Workshop	*	***	***	***	***
Advisory committees	*	***	***	***	***
Public hearings	**	*	*	***	**
Public meetings	**	*	**	**	**
Public inquiry	***	*	*	**	**
Special task forces	*	***	***	***	***
Gaming simulation	*	***	***	***	***
Legend : * Low, ** Medium, *** High					

Table 4. Types of public involvement, according to Vindasius 1974, quoted by Sarjakoski, 1999)

1.13 Roles and actors

According to (Nijkamp and Scholten, 1991), if the type of role for technicians is more or less easy to define, in contrast for interested citizens is not so easy (Table 5) because their requirements are not very easy to know. Indeed, for some of them, their objective is to reach their goal, whereas for other, the means look more important than the goals.

Type of role	Information demand	User demand	Type of GIS
Information specialists	Raw data	Analysis Flexibility	Large Flexible
Preparers of policy	Raw data and pre-treated data (= information)	Analysis Good Flexibility	Compact Manageable
Policy decision-makers	Strategic information	Good accessibility to users; Weighting and optimisation models	*“Small and beautiful”*
Interested citizens	Information	Good accessibility to users	*“Small and beautiful”*

Table 5. Types of user demand for a GIS (Nijkamp and Scholten, 1991, p. 17), quoted by Vico-Ottanà (1998).

Whereas for some other people (Nyerges et al. 1997), PPGIS (for Public Participation GIS) are new tools that foreshadow something more important, a new type of computer collaborative system the main characteristics of which are the following:

- Role of participants - innovation/creation,
- Diversity of views, managing contradictions inconsistencies,
- Output dedicated to public,
- E-mail, archives, real-time analysis,
- Handling plan history and alternatives.

So, two levels of systems can be defined. The first level can be defined as a support for exploration and communication between the actors, and more precisely with the citizens, whereas the second level should be more dedicated for enhancing analysis and deliberation between actors. For details see Table 6 where in addition some examples of computer tools are listed.

Level 1: Exploration/communication support	Level 2: Enhanced analysis/deliberation support
(1) **Group Communication**: idea generation and collection through anonymous input, exchange and synthesis, identification of common ideas. ***Tools***: data/voice transmission, electronic voting, electronic white boards, discussion groups, computer conferencing, and public computer screens.	(5) **Process Models**: descriptive/ simulative models of physical and human spatial processes. ***Tools***: GIS-embedded models, specialized models linked to GIS visualization tools, intelligent agents, expert systems, knowledge bases.
(2) **Information Management**: storage, retrieval, and organization of data. ***Tools***: spatial and attribute database management systems.	(6) **Advanced Spatial Visualization**: virtual realities, multimedia animations. ***Tools***: Mapping, animated cartography, hypermaps
(3) **Graphic Display**: spatial and attribute data visualization. ***Tools***: shared and individual computer displays of maps, charts, tables, images, and diagrams.	(7) **Decision Models**: various decision rules integrating individual and group-derived evaluation criteria with alternatives performance data. ***Tools***: Multi-criteria decision support techniques.
(4) **Spatial Analysis**: basic analytical functions ***Tools*****:** proximity, buffering, overlay, data nanalysis, data mining	8) **Structured Group Process**: facilitated/structured group interaction, brainstorming. ***Tools***: automated Delphi, nominal group technique, electronic brainstorming.

Table 6. Functional capabilities for PPGIS (adopted from Nyerges et al. 1997).

1.14 Towards new visualisation systems

Among new visualisation systems, there is virtual reality which deserves a very important section (§3) in this paper. But the cartography of citizen's opinions is also something important. One key-idea is to use some hypermap techniques to organize those opinions. According to Shiffer (1999)[4], we need:

- **to recollect the past, by using some annotation mechanism** for regrouping what was said, what was done, or what a place was like, etc. However, the lack of documentation or data to support this can lead to inconsistent individual memories. In addition, resulting arguments can dominate a discussion and shift the focus of a meeting from the matters at hand.
- **to describe the present with some navigational aids**; it is necessary to familiarize participants with an issue or area being discussed so that everyone can work from a common base of knowledge. The juxtaposition of media (maps, photos, thematic data, etc.) can strengthen a collective understanding of the various characteristics of a given site or issue. But the lack of access and (more recently) filtering for this information can handicap the description.
- **to speculate about the future** by using some representational aids (per instance virtual reality); the extrapolation of measurable phenomena from past experience and application to the future using informal mental models perhaps more formalized using computer-based analysis tools. But the existing mathematical analysis tools are traditionally limited by speed difficulties and abstract output.

So, storing annotations can be done geographically, chronologically, by association, by relevance, especially by using "post-it notes". Of course, annotation types can vary from.

- Simple Graphical Marks (such as lines, circles, dots, etc.),
- Video Sketching (graphical "what if"),
- Textual Annotation (flexible, low storage/bandwidth),
- Audio Annotation (fast, can be awkward),
- Video Annotation (expressive, compelling, storage/representation concerns),
- Building Blocks or mockups (simple, need more connection to digital representation).

VIRTUAL REALITY FOR PUBLIC PARTICIPATION

Several kinds of visualisation systems can be used for public participation, especially based on virtual reality. Taking again the Verbree et al. (1998, 1999) presentations, we can think of workbench systems, and cave systems.

Both systems are supposing that a complete 3D model of the city is already existing, that a special equipped room is also existing, and that the citizens are provided some head-mounted displays or special glasses. More precisely, two models must exist, the present city, and the planned city.

For urban planning, an ideal Virtual Reality system can give the citizen the impression that he is present both in the actual and the planned environment. First of all it is necessary to fill the space as much as possible with the realistic representation of a model of the study area. With works developing the infrastructure this is often a combination between the existing reality and the new situation. This image has to be created from the model in the same time, which corresponds with the change of viewpoint (real time rendering). This requirement sets up conditions for the hardware and software to be used as well as for the modeling itself.

The most affordable system is the screen of the PC as "window" to virtual reality. The user himself is not present in the system, but it is possible to present an image of the first-person on the screen. By offering nearly simultaneously an image for the left and the right eye through shutter glasses, the brains are capable to reconstruct a 3D-image. This Window-on-the-World can be replaced by a projection on a screen from underneath a table, as on the **Virtual Workbench** (Figure 8a) or by a projection on a large cylindrical screen (Theatre VR). The user of the system is still not really present in the projected world, but because of the large viewpoint the view becomes much better. In order to obtain a good stereoscopic representation a refresh-rate of 2 x 30 per second is necessary. This

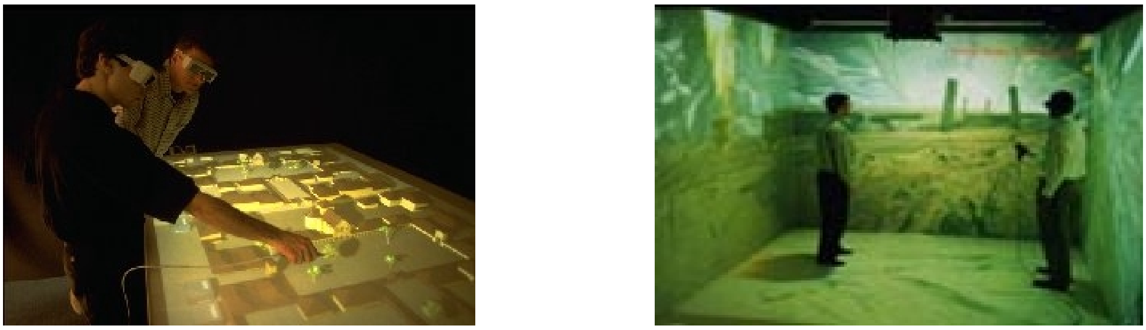
[4] See http://yerkes.mit.edu/shiffer/MMGIS/Title.html for details and animation.

is only possible with specially designed graphical hardware. This also holds for the **Cave** (Figure 8b). Different from the other earlier presented forms of Virtual Reality, the Cave gives users the opportunity to be actually present in a virtual world. This world can be typically created in a space of around 3 × 3 × 3 metres, in which on three walls (in front, on the left and on the right) and on the floor a multiple projection takes place. Also in this case use is made of "shutter glasses" to evoke a 3D-image. Similar to the already mentioned systems several spectators have the possibility to be present. A part of the real world stays visible and manageable.

For an interesting panorama, please refer also to Dodge et al. (1998). One other possibility is still to use non-immersive virtual reality technique, as given for instance for Los Angeles, California. See for more details

http://www.aud.ucla.edu/~bill/UST.html

As an example, let me very rapidly presenting the CommunityWorks software (Figure 9). This product is a place-based decision support system for community planning and design decision-making. Geographic Information System (GIS), 3D visualization and simulation technologies have been integrated in a system designed to be customized by each community. CommunityWorks provides an interactive, realtime multi-dimensional environment in which citizens and professionals can reach consensus on goals, objectives/ policies, and design the future of their community. Citizens, planners, designers, and public officials will operate in a virtual world in realtime, and will have the ability to propose policies, formulate and design alternative scenarios. Over time, they can see how these changes impact their environment physically, fiscally and socially. For a similar example of another company, see also http://www.multigen-paradigm.com.



(a) (b)

Figure 8. Virtual reality. (a) virtual Workbench © http://www-graphics.stanford.edu/projects/RWB/. (b) A CAVE for virtual reality from the MechDyne Company © http://www.mechdyne.com/surround_screen_VR.html

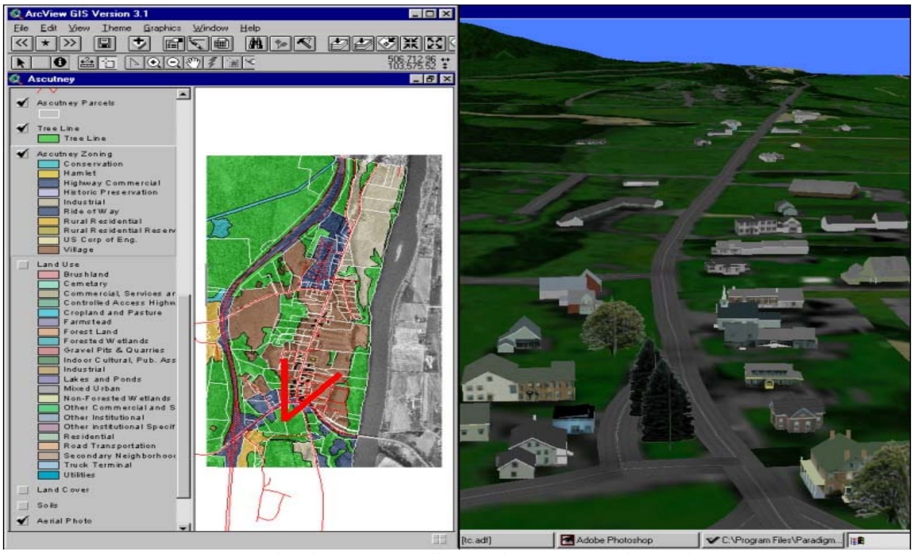


Figure 9. Example of project visualisation from CommunityWorks (Source: http://www.simcenter.org/Projects/CPSP/CommunityWorks/communityworks.html)

EXAMPLES OF INFORMATION SYSTEM FOR PUBLIC PARTICIPATION

To conclude this section on information system for public participation, let us present two examples, the first one in the Twin Cities (Minnesota, USA), the second in Idaho based on a Spatial Understanding and Decision Support System, and the last one in UK.

1.15 Public Participation in the Twin Cities (Craig 1998)

In Minnesota, USA, both Minneapolis and St Paul (named the Twin Cities) require input from citizens on any planning process. For instance, St Paul has divided itself into 17 districts for citizen participation, each of them averaging 16,000 people. Any planning activity must go through a district council before it can be taken up by the city. But Minneapolis has initiated its Neighborhood Revitalization Program, the goals of which are to reorganize the building neighborhood, to create a sense a community and to increase the collaboration. This process involves six steps:

- Develop a participation agreement that spells out how to proceed.
- Build a diverse citizen participation effort. A Neighborhood Revitalization Program steering committee reaches out to the community to learn about issues, needs, and opportunities.
- Draft a plan. This should address top issues in the neighborhood with clearly defined objectives.

- Review and approve the plan at the neighborhood level.
- Submit the plan to government for review, approval, and funding.
- Implement the Plan, that is to say *"The neighborhood organization staff and resident volunteers help carry out, monitor and revise the plan as it is implemented. Cooperation with government staff, nonprofit organizations and the private sector ensures successful and timely implementation of the Neighborhood Action Plan"*.

In this process, one of the key-issue was the creation of a web site (http://www.freenet.msp.mn.us/org/dmna/ including the following characteristics:

- Hot Topics (e.g., major change in membership rules, or copy of new Minneapolis Plan for comment),
- Official Documents (e.g., bylaws, copies of all correspondence),
- Board Meetings (director names with email links, meeting minutes),
- Neighborhood Revitalization Program details (e.g., official agreement, survey results, meeting minutes),
- Information about the neighborhood (e.g., Census data, address and other details for all residential buildings, political representatives with email links, skyway map and hours, business directory),
- Links to Local Media Stories (e.g., construction noise violations, downtown as a place to live, skyway system),
- Links to Related Local Sites (e.g., bus schedule, local government sites and publications, activity guides, Greater Minneapolis Convention and Visitors Association),
- Links to National Sites (e.g., International Downtown Association, Project for Public Spaces, National League of Cities).

1.16 Decision Support via the World Wide Web (From Kingston 1998b)

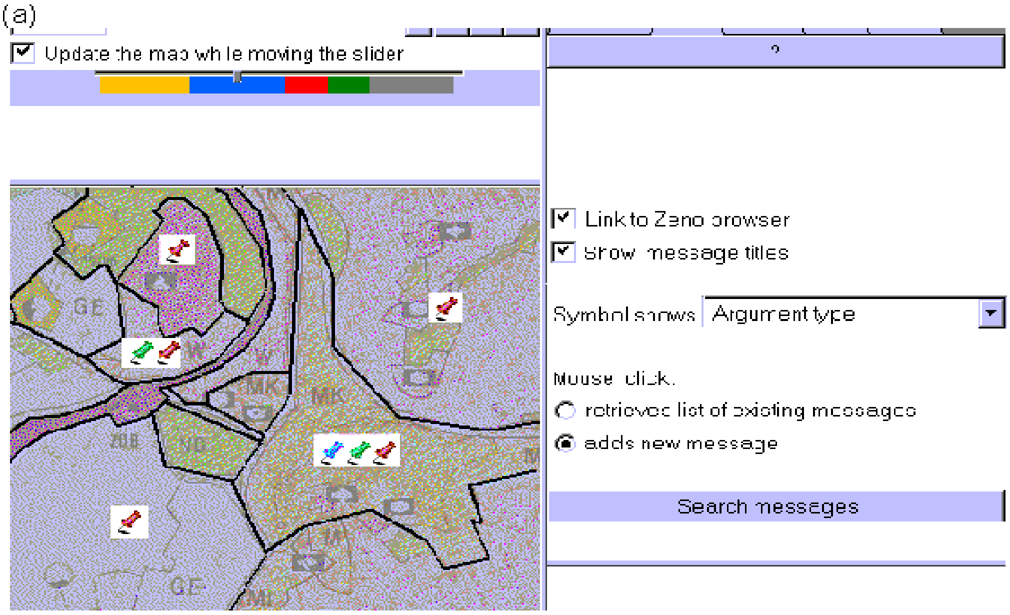
By providing access to appropriate data, spatial planning models and GIS via user-friendly web browsers the WWW has the potential to develop into a flexible medium for enhanced public involvement in the planning process. Several web based systems can now be found on-line but the majority of these tend to be demonstration systems using sample data which are not necessarily problem specific and are therefore of little interests to the majority of the public. Many of these systems merely provide information in a uni-directional form such as listing planning applications and publishing development plans. In the UK, Devon County Council's Structure Plan was put on-line providing access to documents outlining the Council's strategic policies and proposals. Details on how to object to the proposals and the times, dates and places of meeting were also provided. But, the system lacked any ability for the public to interact with the plan by populating the system with their own information, ideas or objections. Visit Devon County Council's Structure Plan web pages for details: http://www.devon-cc.gov.uk/structur/.

ARGUMAPS (RINNER 1999)

Recently, Rinner (1999) has proposed a new concept named *Argumaps* (Argumentation Maps) which is based on argumentation and hypermaps (Laurini 2001, Chapter 5).

Participants of spatial planning discussions refer verbally to geographic objects. For example, an argument supporting a new industrial zone refers to the appropriate map location. An argument against the construction of a new highway refers to the distance between the planned route and a housing area. So, Rinner has proposed an explicit linkage between online maps and discussion contributions for being used in a World-Wide Web-based support systems for Collaborative Spatial Decision-Making.

(a)



(b)

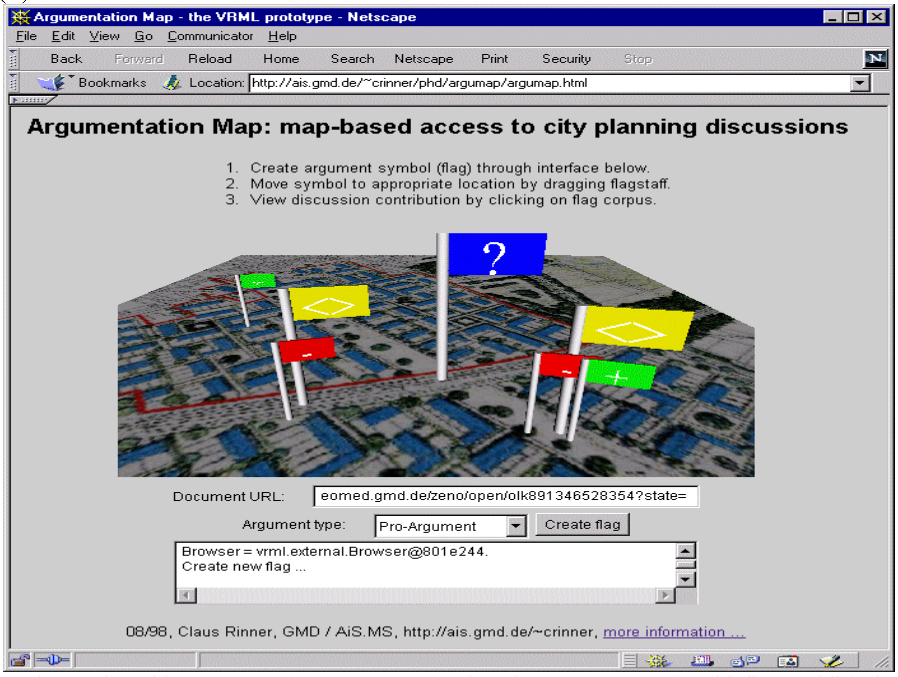


Figure 10. Navigation session with Descartes (Rinner 1999). (a) by pin-pointing arguments. (b) with flags. Published with permission

The representation and storage of geo-referenced arguments in Argumaps would advance the level of integration and utility of electronic discussion forums and digital plans. Argumaps will provide graphical tools for visualizing geo-referenced contributions and for interactively following links between arguments and map objects. Thus, users involved in public planning debates have a navigable cartographic "index" to a discussion that enables them to explore spatial structures in the arguments.

In addition, functions for querying and analyzing geo-argumentative relations and for facilitating the submission of constructive contributions will be available. The quality of planning discussions will benefit from an improved retrieval and use of available documents.

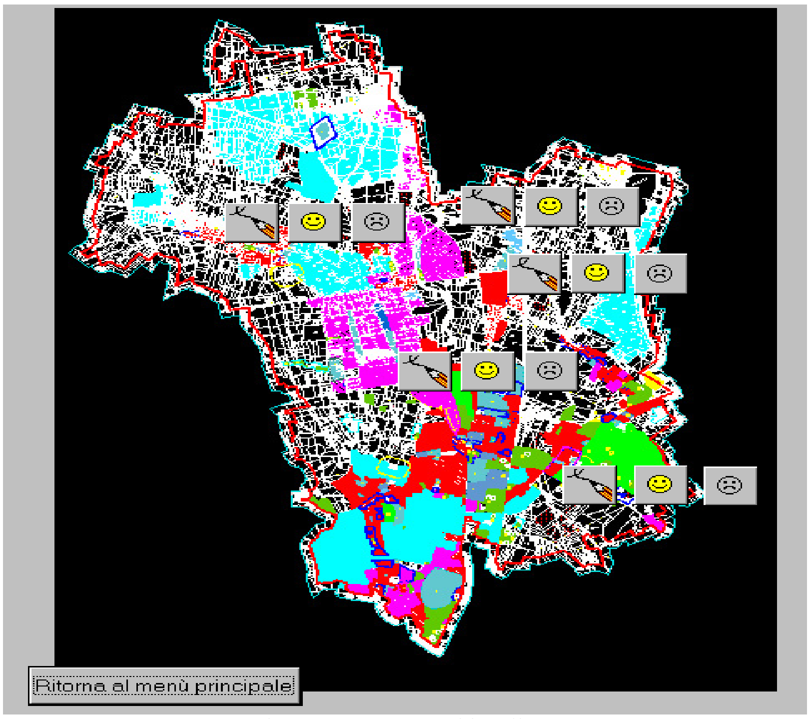


Figure 11. Argumaps with smileys.

Aggregated data about a plan-related discussion can be visualized like any other geo-referenced data set. The Figure 10 shows the distribution of the difference in number of pro arguments minus contra arguments per geographic object, assuming that the map features were planning areas, linked to contributions of discussion participants. Two modes of locating the arguments are shown, by pin-pointing (Figure 10a) or with flags (Figure 10b). In conjunction with the colour scale, the map enables the viewer to capture immediately what regions have been more (red/dark grey) or less (green/light grey) disputed than the white reference area, and which area has been most contradicted. This system can easily be extended to store vocal arguments. In addition, Figure 11 exemplified another possibility with smileys.

CONCLUSIONS

As described in this paper, modern technologies allow to radically change the nature of public participation to decision regarding urban planning. Only a few examples were given giving an hint of what will be possible in the future. Exchanging experiences between countries will be very fruitful, for instance under the aegis of association such as the International Association for Public Participation (IAP2), whose goals (www.iap2.com) are as follows:

- Serve the learning needs of members through events, publications and communication technology;
- Advocate for public participation throughout the world;
- Promote a results-oriented research agenda and use research to support educational and advocacy goals;
- And provide technical assistance to improve public participation.

For the future, some are forecasting the apparition of a new kind of citizen, named cyber-citizens, or sometimes cyber-spatial citizens, who will be citizens using new information technologies to act as real citizens, especially in connecting with authorities.

To get more information about this increasingly important practice, please contact also the forum ppgisforum@spatial.maine.edu.

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