Sustainable Urban Development
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The Framework and Protocols for Environmental Assessment
Steven Curwell, Mark Deakin and Martin Symes (eds)

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Sustainable Urban Development

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Edited by Mark Deakin, Gordon Mitchell, Peter Nijkamp and Ron Vreeker

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Participative and Interactive Evaluation: A Review of the Methodologies

Andrea De Montis

INTRODUCTION

According to many research studies on the relationships between impact evaluation and planning, the reaction to so-called 'rationalism' has led professionals and scholars to search for alternative assessment methods. One of the main lessons drawn from the criticism of rationalism is that assessment should not become a process mastered by an independent actor, such as a planner, a professional, or a technician. Instead it is generally agreed evaluation should be more participative and based on the capacity for social interaction, mutual learning, and communication.

This examination of more participative and inter-active evaluation is organized as follows: first of all, the shift towards interactive methodologies is introduced. Secondly, the concepts of mutual learning, social interaction and communication are set out. Following this, a number of case studies of interactive planning support systems are described. Finally, conclusions are drawn about the interactivity of decision-support systems.

A RADICAL SHIFT TO INTERACTIVITY

Evaluation and planning are intertwined activities. Many scholars (Khakee, 1998; Lawrence, 2000; Secchi, 2000) would agree, even from their different points of view, to the statement that evaluation and planning, like two sides of the same coin, have evolved over time in a similar pattern. Thus the reflections on evaluation in this chapter shall mainly be linked to the associated planning process.

Both Khakee (1998) and Lawrence (2000) depict an historical evolution of planning and evaluation as a reaction to the so-called 'rational-comprehensive' approach. According to Lawrence (2000), this reaction has been concentrated so far on the following negative tendencies:

- autocracy (where 'experts' dominate the process, with only a peripheral role for the public);
- failure to consider resource and cognitive limits;

- overestimation of the ability to predict and control the environment (weakness in implementation);
- insufficient consideration of non-rational aspects (creativity), of synthesis (compared to analysis) and of non-technical and non-scientific knowledge, experience, and wisdom (scientific, technical, and quantitative bias);
- failure to consider the collective nature of planning and the central role of dialogue adequately.

Despite these pointed criticisms, rationalism has persisted until now for many reasons, but mainly due to the 'psychological reassurances it provides practitioners' (Lawrence, 2000: 610).

The shift from rationalism in planning and evaluation has resulted in a range of practices, concepts, and behaviour, which can be grouped under different 'styles' or philosophies. Khakee identifies seven variations on the theme: incremental planning, implementation-oriented planning, strategic planning, advocacy planning, transactive planning, negotiative planning, and communicative planning. Lawrence, on the other hand, provides the readers with a different aggregation of the same concepts in four approaches: pragmatism, socio-ecological idealism, political economic mobilization, and communication and collaboration.

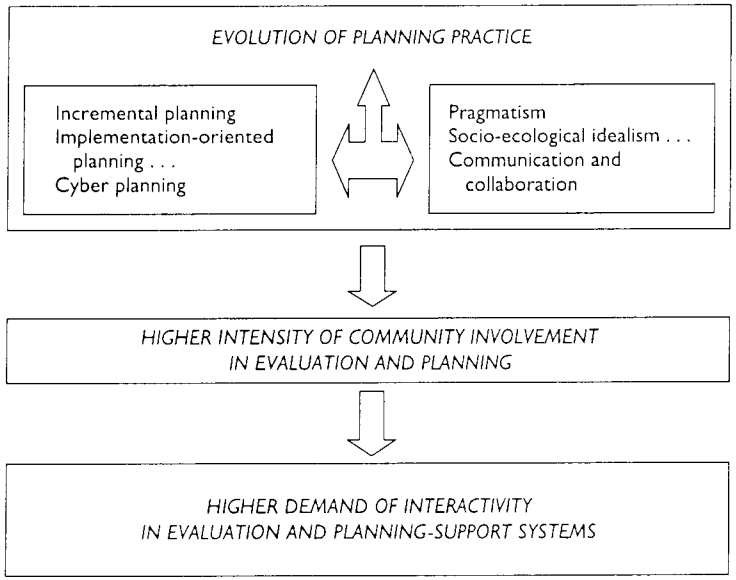

Figure 23.1 A basic assumption: the shift to interactivity in evaluation and planning

It should be noted that the differences between these approaches are usually semantic. In practice, planners often adopt mixed approaches and only partly implement many of the aforementioned styles. Moreover, the most recent approach to evaluation and planning should be added to the lists quoted by Khakee and Lawrence: the so-called 'digital planning', known also as 'cyber planning'. The failure of researchers to consider cyber planning as a 'style' of planning in the proper sense of the term may be due, in the first place, to the broadness of practices connected to it and, secondly, to the lack of real references. The following attempts to overcome this.

In a four set simple classification of interactive evaluation, planning processes may involve real working environments, such as traditional meeting points and councils, and virtual ones, such as tele-conferences and Web-based forums. They also may imply focussing on both real objects, such as a stone city and a concrete ecosystem, and virtual objects, such as computer-modelled cities and utopian settlements.

From this point on the said taxonomy will be termed real/virtual planning (*RVP*) classification, and the corresponding four sets will be called *RR*, *RV*, *VR* and *VV* domains (see Figure 23.2).

Many sceptical scholars warn that a digital divide still exists, which prevents an unlimited number of citizens participating in effective and deliberative decision-making by means of cyber planning. On the other hand, it seems that cyber planning may emphasize and enlarge most of the activities, which are now usually attributed to the communicative approach.

One of the major criticisms about rationalism is that it encourages practitioners to regard problems as 'obvious' and thus to choose mono-directional and

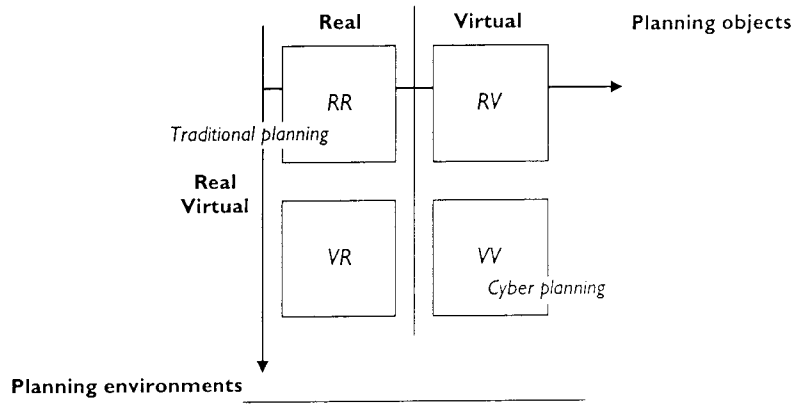

Figure 23.2 Scheme of the real/virtual planning (*RVP*) classification (Adapted from Batty, 2002)

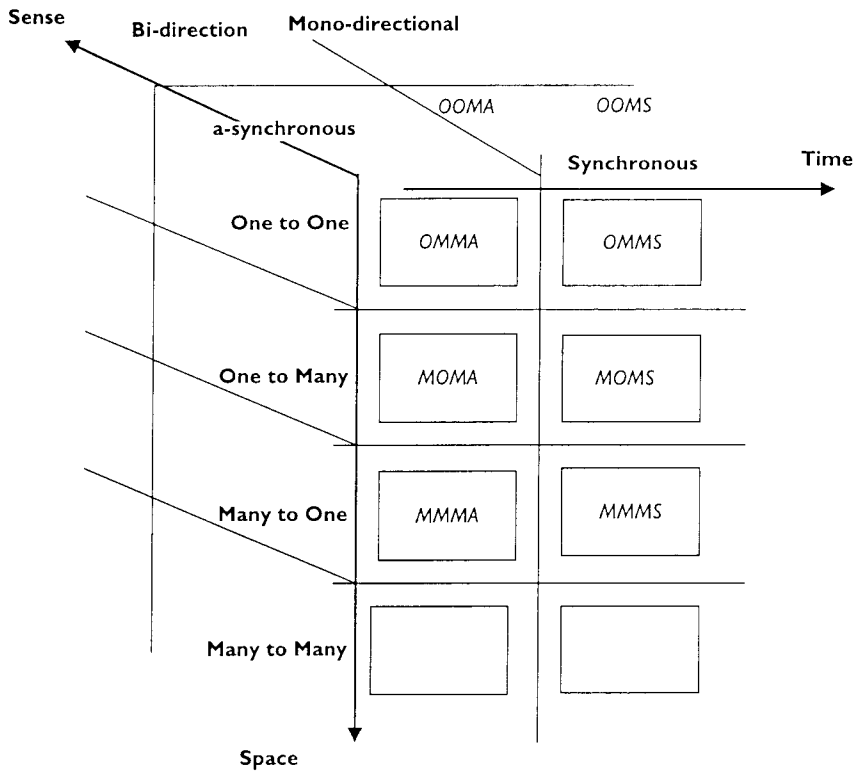

Figure 23.3 Scheme for the spatial-sense-temporal (SST) classification (Mitchell, 1999)

linear solutions. As for the reaction against rationalism, many approaches emphasize that questions, bottlenecks and problems first should be set and then solved. In this sense, patterns of managing information definitely matter. Starting from a four-box Table recently developed by Mitchell (1999), information exchange modalities can be classified into 16 different sets, with reference to space, sense, and time. Here information flows may occur in one-to-one, one-to-many, many-to-one, and many-to-many patterns. The permitted sense may be mono or bi-directional, while temporal modalities may be synchronous or asynchronous.

From now on, this taxonomy will be termed the 'spatial-sense-temporal' (*SST*) classification, and each domain will be indicated by the corresponding initial capital letters. An example is sketched in Figure 23.3, with reference to eight mono-directional domains.

INTERACTION AS A MEANS OF LEARNING IN COMMUNICATIVE AND CYBER STYLE PLANNING

During the past 30 years, practitioners and scholars have observed an explosion of applications aimed at interconnecting several points and allowing for interactivity among them. This is an evident phenomenon and parallels the diffusion of communicative and collaborative, as well as cyber styles of planning.

According to some authors (Forester, 1989, 2000; Sager, 1994; Innes, 1998a), interactive evaluation can be conceived as a complex process, with great emphasis on the way information is transmitted so that learning is facilitated among as wide a possible number of stakeholders. In these conditions, evaluation operates on an often non-systematic set of steps and involves consensus building, social mobilization, participation, and negotiation (Healey, 1997; Innes, 1998b). Here the argumentative capacity of planners becomes a central part of their activities when presenting the questions at stake, in discussing them, reflecting on different alternative scenarios and also, when necessary, in changing the main assumptions formulated at the beginning of the process (Forester, 1993; Healey, 1993, 1996).

Within this paradigm, decision-making is based on a deliberative attitude that implies continuous feedbacks through cyclical patterns along a route that usually cannot be predicted in advance (Healey, 1992; Innes and Booher, 1999). Thus there is particular interest in the development of methodological frameworks, operative strategies, and practical devices to encourage participation, involve communities, and allow for direct interaction throughout the process. In this sense, interactivity is always invoked, as a means of inducing learning by acting in a bi-directional and constructive environment.

In cyber planning and evaluation, the widespread diffusion of applications of the so-called 'information and communication technologies' (ICTs), both in an Internet and intranet pattern, means that interactive dialogue, learning, and evaluation processes can take place among agents situated in a virtually unlimited number of places (Castells, 1989, 2001; Levy, 1994, 1995a,b). One or more digital devices give shape to a cyber environment able to support bi-directional flows of information and, thus, interactivity. Planning and evaluation might occur also as deliberative processes based on public access with a degree of extension as large as that which net providers permit (Mitchell, 1995, 2000). The environments of these processes can occur both in physical settings, such as traditional meeting points, as well as in digital ones, such as virtual halls and laboratories.

This methodological shift seems to involve a change in practice. New demands require integration of the applications and produce a new generation of systems for the support of planning and evaluation. Hence one observes the diffusion of planning support systems (from now on called PSS), which embed interactive features,

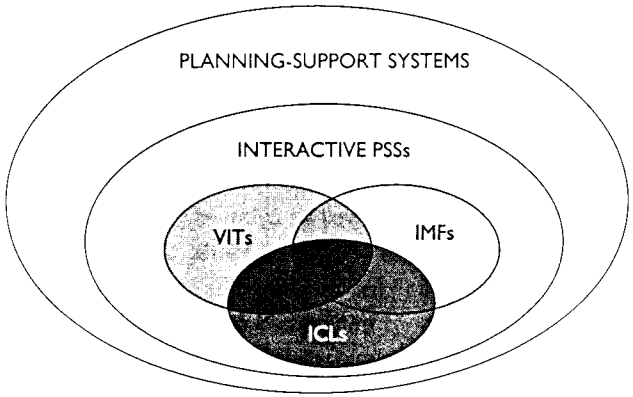

Figure 23.4 The relationships among PSSs, IPSSs, VITs, IMFs, and ICLs: a tentative classification

are accessible on-line by unlimited numbers of users, provide them with digital collaborative environments, and encourage the construction of shared contextual knowledge (see Bodum and Kjems, 2003; Moon, 2003; Shen *et al.*, 2003).

Incorrectly designed sophisticated systems, even though they allow advanced analysis, may discourage users from exchanging information or sometimes from any kind of interaction. Hence, the effectiveness of a PSS depends on its degree of interactivity, which is often proportional to the extent to which the visual devices used are suitable for constructing an intuitive language within the man–machine interface.

INTERACTIVITY IN THE DOMAIN OF PSS PRACTICE: LESSONS FROM A REVIEW OF CASE STUDIES

In a hard and information technology-driven sense, a PSS is defined as a computerized system, or an integration of many such systems, which is able to support judgement, evaluation and, thus, planning. In a softer sense of the word, and also for PSS designers, PSSs cannot be reduced to mere PC-programs. They have to be conceived as entire processes, as decisional environments, and as institutional settings, where planning activities are able to evolve successfully. Thus the technological aspect of a PSS, its computerized engine, is only useful functionally if the related planning process evolves properly. In government, PSSs can be used for processes where planning is supported and decision-making aided. Hence, a PSS can be defined as a system that embraces computer devices, institutions, procedures, officials, persons, citizens, and stakeholders, who wish to be involved and want to collaborate in attaining changing tasks in planning.

Interactive community learning scheme-based processes

Analysis of the scientific literature on environmental impact assessment shows that in many cases collaborative learning has been considered a successful strategy for involving communities in discovering new opportunities and developing innovative knowledge while participating in the activities.

Saarikoski (2000) describes the positive contribution of a task force for public involvement in a controversial debate on waste management in the region of Pirkanmaa, Finland. The main concern was the disagreement within the society about the policies directed at energy conversion. While a regional company responsible for waste management proposed incineration, non-governmental organizations claimed that the method chosen would be risky for the communities because of the increase of air pollution. The role of the task force was to follow each step of the impact evaluation process and to communicate and explain all the elements: its commitment, the policies of the stakeholders, feasible alternatives for waste management, possible impact, and criteria for decisions.

The task force developed traditional participatory instruments: seminars and meetings. The research effort was focussed on the degree of community involvement and pointed out that benefits were mainly obtained from full availability of documentation. Clear descriptions were given of the alternatives at stake, and everyone was aware that the ideas expressed by each party were included in a final report. Evidence was provided that some actors had changed their original opinions about the best alternative to endorse, while others had learned from the information and materials presented by their opponents and sometimes revised their original remarks.

Overall the exercise was deemed successful, because despite its shortcomings and legitimacy failures 'the process managed to produce a rather broad understanding among the parties and improve the communication among them' (Saarikoski, 2000: 699). With respect to the *RVP* classification, this case falls in the real-real (*RR*) domain, since it is based on face-to-face group meetings and on the use mostly of paper-based documents. According to the *SST* classification, this process belongs to the domain of one-to-many, bi-directional synchronous (*OMBS* domain) flow of information. It evolves along contemporaneous meetings based mostly on presentation of materials by a few speakers in a mono-directional pattern.

It should be noted that a great awareness exists of the need to involve as many public actors as possible in the evaluation procedure. Sometimes the focus of the process cannot be as clear as in the above-mentioned case of waste management policy. When long-term concerns are considered, strategies for regional involvement have to be developed (Wolfe *et al.*, 2001). In such cases, one should note the

difficulty that the US National Assessment of Potential Consequences of Climate Variability and Change (NACC) has in finding strategies for constructing a collaborative public process for the evaluation of concerns that will only become urgent (hopefully) in the very long run.

While a huge effort has been made to distribute guidelines in 19 US regions and over several actors on the most effective participative strategies, the researchers did not understand clearly to what extent these documents were being adopted and used in practice. With respect to the *RVP* classification, this process belongs to the *RR* domain: working environment with mainly real workshops and assessment committees, although paper-based documents are utilized. In the *SST* classification, information has been managed in this process in a one-to-many, mono-directional, and asynchronous pattern (*OMMA* domain).

Sinclair and Diduck (2001) warn that the existence of an evaluative stage dedicated to public involvement does not ensure *per se* that final decisions will be made in a collaborative and multi-actor framework. Sinclair and Diduck (2001) observe that environmental evaluation, in its first stages, was applied using a rational-comprehensive approach. Participation was necessary, but only under the supervision of a technical leader and using top–down driven patterns. No change in direction of the original policy was conceived. There were no elaborated methodologies to cope with active and, thus, interactive public societies. In the last 20 years, there has been a shift to approaches based on a trans-active model of planning. This is mainly due to the evidence that impact evaluators must often cope with conflict, uncertainty, fuzziness, and change.

In view of this observation, it is argued impact evaluation should be 're-conceptualized as a form of trans-active, civic exploration reliant on mutual learning by all EA participants' (Sinclair and Diduck, 2001: 132). Here attention focuses on patterns of adult learning, pointing out relevant relationships and the need to adjust the learning process to the social context. On the basis that the theory of ideal conditions of learning can provide a good starting point for evaluation, Sinclair and Diduck (2001) attempt to define transformative learning as 'a process by which individuals improve their instrumental and communicative competence and develop more functional frames of reference' (Sinclair and Diduck, 2001: 114). The six rules of thumb of the transformative learner are accurate and complete information, freedom from coercion, openness to alternative perspectives, the ability to reflect critically upon presuppositions, equal opportunity to participate, and the ability to assess systematically and to accept a rational consensus as valid.

These rules have been used as reference criteria in evaluating 34 jurisdictional frameworks of impact assessment in Canada. Among the resulting proposals for

policy reform, the following seem to be relevant: that government reclaim the responsibility for design and implementation of public involvement programmes; they enact fair and reasonable participant funding mechanisms; formalize public involvement at normative and strategic levels of planning; and availability via Internet guidance notes.

According to the *RVP* classification, the proposal of policy reform seems to suggest moving to the *RV* domain by adopting real working settings and digital Web-based documents for public involvement. Within the *SST* taxonomy, the proposed policy reform encourages the development of processes where information flows evolve in a many-to-many, bi-directional, and synchronous pattern (*MMBS* domain). With reference to a similar framework, Blatner *et al.* (2001) discuss the move Interactive evaluation from the rational approach to the collaborative learning approach. Here collaborative learning is believed to be based on a merger of three theories: soft system methodology, alternative dispute resolution, and learning theory. The result is 'a process designed to create a learning atmosphere, encourage systemic thinking about complex problems, discourage strategic (competitive) behaviour among stakeholders, and focus on desirable and feasible change rather than attempting to achieve absolute consensus on contentious land management issues' (Blatner *et al.*, 2001: 248). As in the previous case, classifications are referred to the proposed paradigm of community learning within land-use decision-making. According to *RVP* classification, this process seems to imply real working environments and real objects (*RR* domain), while the *SST* taxonomy indicates a tendency to incorporate many-to-many, mono-directional, and synchronous patterns of information flows (*MMMS* domain). Other authors present scientific evidence, which confirms that public participation, knowledge elaboration, and management and social learning are fundamental elements in successful evaluation activity in social domains (see Goma *et al.*, 2001; Sánchez-Triana and Ortolano, 2001; Deelstra *et al.*, 2003; Fagerström *et al.*, 2003).

In relation to social impact assessment, recent research emphasizes the role of the interactive community forum (ICF) (Becker *et al.*, 2003). This project was developed for the US Army Corps of Engineer's environmental impact study of alternatives for salmon recovery in the Snake River basin region of the United States. The ICF is a participatory approach to social impact assessment focussed on the assessment 'of citizen's judgement of the anticipated impacts of EIS alternatives' (Becker *et al.*, 2003: 368). The approach developed within the ICF is linked to the theories of small group interaction, since it facilitates open dialogue and discourse, promotes mutual learning, enhances the quality of individual judgement, and advances participatory democracy and empowerment. The main working framework was a cyclical

process based on the following four steps: presentation of supplementary information; record of initial rating for each community dimension; facilitated group dialogue of individual rating and perspectives; and final rating and justification for rating.

Despite some shortcomings in the method, the ICF was found to enhance the community's understanding of each alternative in the impact assessment procedure and thus to increase its social deliberative capacity. According to the *RVP* taxonomy, this particular IPSS falls onto the *RR* domain, implying real working environments – a series of meetings – and real planning objectives – traditional documents. Along the *SST* classification, it belongs to the *OMMS* domain of the one-to-many, mono-directional, and synchronous patterns of information flows.

VISUAL INTERACTIVE TOOLS-BASED PROCESSES

According to recent studies, group learning among adults is an activity that can be encouraged by the adoption of suitable devices able to support collaboration and interaction. These tools, such as personal computer or Internet-based programs, are usually conceived and designed to allow for intuitive patterns of manipulation and use. There is no doubt that visual modelling still provides users with the most effective method of communicating in an intuitive and easy-to-grasp manner. Interactivity is thus directly dependent on a user-friendly visual interface between man and machine, available within the system.

A meta-analysis of 19 quantitative studies (Horton *et al.*, 1993) found that the collective learning tool of concept mapping enhanced knowledge attainment and attitudes. Concept mapping is a technique for representing knowledge in network graphs. It is often used successfully in planning support systems for several purposes, such as collective generation of scenarios, consensual building of master plan alternatives, and shared construction of criteria of environmental performances. In a recent study, Chiu *et al.* (2000) investigated the effectiveness of concept mapping on the interactions in a computer and Internet-based collaborative environment among 36 in-service teachers and pre-service student teachers in Taiwan. The system's visual interface, constructed on an Internet-based platform, allowed clients to access a chat room, construct a group concept map, obtain a feedback score of communicative performance online, and track the information about the process. The system also permitted the map of dialogues constructed by group members to be traced and the final resulting map shared. One of the main results was that the performance of the group was positively related to the amount and level of group interaction in network-supported concept mapping. Moreover, this result

was directly linked to the presence of an adequate and attractive visual interface between groups and the Internet-based system. This visual interface encouraged a high degree of interaction among individuals and groups. According to the *RVP* classification, this system falls into the *VV* domain, since it implies digital working chat rooms and bits-based map files. Within the *SST* taxonomy, this process belongs in the *MMBS* domain, since it allows information to flow in many-to-many, bi-directional, and synchronous patterns.

Moving from the general field of education to planning, within an interactive participatory process on conservation planning in Loess Plateau, China (Fagerström *et al.*, 2003), several techniques were adopted to encourage interactions between farmers, as potential field researchers, and professionals. Three groups of methods were used to involve as many farmers as possible: sampling, interviewing and dialogue, and methods of visualizing and diagramming. Visual tools used included visual sketch models, timelines and seasonal calendars, ranking, and flows and diagrams. Visual models in particular 'were the main tools for studying current land resources in space and landscape' (Fagerström *et al.*, 2003: 8). They were constructed in two patterns: village sketch maps and village models. The first was based on a topographical map including all possible information on settlements, cropland, and other resources. The second model was constructed directly by the farmers as a 2×3 m three-dimensional rectangular model and with the heights sized at approximately the scale 1:600. Information was gathered by means of direct surveys and mapped with the use of materials such as stones for representing bedrock, soil/water mixture for topography, leaves for woodland, and crushed chalk of different colours for land use. The adoption of visual tools was found to be very effective especially because of language barriers caused by the complexity of the Chinese tongue for both the foreign researchers and the indigenous farmers themselves. The process is believed to be suitable for involving farmers in the whole planning process, so as to explore relevant alternatives for sustainable land use. According to the *RVP* taxonomy, this system belongs to the *RR* domain, as far as face-to-face real meetings and interviews support debates over very real visual models. According to the *SST* classification, this learning process falls into the *MMBA* domain of the many-to-many, bi-directional, and asynchronous patterns of information flow.

In ecosystem modelling, many studies focus on interactive visual tools in an attempt to favour the interpretation and manipulation of geographic information for learning and planning purposes by non-geographers. Chertov *et al.* (2002), for example, propose a combination of two spatial simulation software systems, EFIMOD 2 and DESCARTES, to construct spatial-temporal interactive maps to support Sustainable Forest Management (SFM). While the first system is constructed to

manage simulations of environmental dynamics, the DESCARTES software system is a 'specially designed to support visual exploration of spatially reference data' (Chertov *et al.*, 2002: 51). Special features of this system are: the automated presentations of data on maps and the ability to manipulate these maps interactively. Future developments of the system include the management of spatial-temporal maps and their integration in methods for multicriteria spatial decision-making. According to the *RVP* classification, this IPSS falls into the *VV* domain, since it provides the user with a digital working environment, enabling to manipulate virtual geographical maps. Within the *SST* classification, this system belongs to the *OOBS* domain, as far as it allows for one-to-one, bi-directional, and synchronous flows of information.

In planning, Al Kodmany (1999) discusses the beneficial contribution of the use of three visualization techniques in encouraging public participation in a planning of neighbourhoods in Pilsen, Chicago, IL, United States. These techniques are as follows: GIS manipulation of maps, sketching by an artist, and digital photo manipulation. While at the beginning of the process GIS provided a wealth of information about the geographical features of the places, which were the object of the future plan, the artist's sketches based on the ideas of each participant along with photo manipulation were fundamental in visualizing non-technical and psychological unfolded aspects of the proposed scenarios. Within this pattern, each participant had the opportunity to visualize directly the possible effects of the proposed plan, as he could see the most likely changes, first sketched as drafts and then reported in a photographically realistic reproduction of the area.

The main result of this study is that the combination of different visual techniques may well help in bridging the gap between planners, usually conceived as scenario-makers, and citizens, seen as scenario-takers. 'Freehand sketching and GIS were most effective for problem *identification* and brainstorming, while photo manipulation using computer imaging was most useful for exploring solutions to *previously-defined* issues' (Al Kodmany, 1999). With respect to the *RVP* classification, this IPSS falls into the *RV* domain, as far as it is grounded on face-to-face meetings and the use of virtual maps and geographic analysis. According to the *SST* taxonomy, it belongs to the *OMMS* domain, since information flows in a one-to-many, mono-directional, and synchronous way.

While in the above-mentioned case participation was encouraged by means of models – visual tools – in the sense they provide concrete reproductions of buildings and land cover – other pioneer researchers (see Shiffer, 1992) have attempted to foster participatory planning processes using virtual models (visual tools again) now considered as digital copies of physical entities. After more than a decade of experimentation, research still tries to combine the high performances of

visual modelling provided by computer system-based virtual environment, with the ease of understanding and use offered by computerized, workbench-based physical relationships and commands. This system consists of a 36″ × 48″ horizontal touch-sensitive screen and allows manipulation either in direct ways, via human hands, or indirect ways, via pull-down command menus. This visually powerful interface can be accessed from all its four sides and encourages the participation of many users by direct actions on the screen and observation of the manipulative strategies of the other users. In this way, this system is believed to foster mutual adaptive learning by a continuous series of attempts towards collaborative sketch planning and design. Observation of the workbench in use demonstrates that users appreciate the opportunity to refer to a horizontal workspace and manipulate it directly. A process of quick adaptation has been recognized, while the round interface has provided a stimulating collaborative environment for planners. According to the *RVP* classification, this IPSS falls into the *RV* domain, as far as it involves the manipulation of virtual models within a real workshop. With respect to the *SST* taxonomy, it belongs to the *OMBS* as it allows the dialogue between one computer system and many (maximum four) users in a bi-directional and synchronous way.

Interactive multicriteria framework-based processes

Multicriteria analysis is grounded on almost 40 years of history in research efforts. Recently many studies have focussed on two directions: interoperability-based and interactivity-based multicriteria systems. These tools are likely to become part of the complex architecture of communicative planning-support systems, by interfacing with other computerized systems and by encouraging active participation of all the stakeholders involved. While there is an overwhelming mass of literature, three references, in particular, provide an adequate idea of these research efforts.

Bana e Costa and Vansnick apply multicriteria analysis to a real decision-making process, by means of a combination of several decision-support systems (Bana e Costa and Vansnick, 1999; Bana e Costa *et al.*, 1999). The integration of different approaches was applied to a complex strategic problem faced by the Santa Caterina textile industry in southern Brazil. The construction of the whole process took place through a series of recursive cycles: there was a great need for interactivity to manage the flow of feedbacks to the beginning of the process. Four computer programs assisted the process in different stages: Graphics COPE (Banxia Software, 1995); MACHBETH (Bana e Costa and Vansnick, 1997); VISA (Visual Thinking International, 1995); and EQUITY (Krysalis, 1995). Graphics COPE

was the main support for cognitive mapping, which in the first phase was dedicated to setting up the problem: this program allows digital maps to be constructed where fundamental and basic points of view are identified. Inter-criteria preference modelling was supported by MACHBETH, a multicriteria computer program with an interface that allows visual interactive learning through the construction of the judgement matrix, the choice of the type of the criteria measurement scale, etc. VISA was adopted to aid evaluation of the competing capacity of the textile firms, by visual sensitivity analysis of the final input, depending on the fundamental and basic points of view. The program EQUITY enabled directions for strategic action in each company to be generated and exploited, by means of intuitive representation of the results of the cost–benefit efficiency analysis. One of the main methodological findings of this process is that each computer program contributed, by means of its visual interactivity features, to the fostering of mutual learning between the actors and to construct common scenarios for the future strategies of the firms. According to the *RVP* classification, this IPSS seems to fall into the *RV* domain, as far as it involves the manipulation of virtual models within face-to-face workshops. In regard to the *SST* taxonomy, it belongs to the *OMBS*, since it allows for the dialogue between a computer system and group members in a bi-directional and synchronous way.

Group decision-making is believed to be a very complex activity, since group preferences cannot be inferred immediately from the simple 'sum' of the judgement scores of the group individuals. Mutual changes may induce uncertainty and groups may suddenly change their aggregate opinion to completely different kinds of concepts. Kim and Choi (2001) have recently developed a multicriteria inter-active program, RINGS, able to interactively construct and manage group utility functions. The system adapts to situations of incomplete information, by 'modifying its information to be a concrete or a complete one' (Kim and Choi, 2001: 501). In this system, all the elements of a multi-criteria procedure, participants, alternatives, attributes and dominance relation information are stored in table form and can be processed using a linear programming model-base. RINGS presents a user-friendly visual interface, which helps group members to express preferences and compare them. According to the *RVP* classification, this IPSS falls into the *RV* domain, as far as it involves the manipulation of virtual models within a real workshop. In relation to *SST* taxonomy, it belongs to the *MMBS*, since it allows the dialogue among many actors in a bi-directional and synchronous way.

A feature often mentioned in a multi-criteria aid process is that algorithms may be able to offer results suitable to changing demands. A high degree of volatility, arising from the changing requests of different customers, occurs in the planning procedures of the sequence of shots to be taken from a satellite camera.

This has to be regarded as a day-by-day adaptive process. In a recent application, Gabrel and Vanderpoten (2002) have developed an interactive multicriteria device able to construct a shot-plan, which conforms daily to the requirements of the customers. The multi-criteria framework consists of two modules. The first is an algorithm able to analyse graphs in order to find the shortest path among the set of feasible ones. The second module helps to explore the set of candidate sequences in a flexible way. Two levels of interaction are allowed. The first one organizes the discussion of the criteria and their relevance, meant as 'aspiration level' (Gabrel and Vanderpoten, 2002: 541). The second level allows one to add further requirements even after criteria selection. According to the *RVP* classification, this IPSS falls into the *RV* domain, as far as it involves the manipulation of virtual models within a real working setting. In relation to *SST* taxonomy, it belongs to the *OOBS*, since it involves man–computer dialogues in a bi-directional and synchronous way.

CONCLUDING REMARKS

In this chapter, a tentative state-of-the-art on the applications of interactive evaluation methodologies within decision-support systems has been elaborated. The case-study reviews set out provide the reader with a rich panorama of applications and confirms that widespread efforts are being made to promote forward-looking interactive participatory evaluation tools in planning. The case studies have been grouped for classification purposes into three groups: community learning (*ICL*), visual (*VIT*), and multi-criteria (*IMF*) IPSS. However, these sets are neither complete nor mutually exclusive. Even if each case study belongs to one set only, it may prove to be twofold or threefold and might belong to other sets. Since the introduction of interactivity in evaluation and planning-support systems is believed to be connected to the possibility of the increase in cyber planning and to the informational society, the examples described have also been analysed with respect to two other taxonomies called real/virtual planning (*RVP*) and spatial-sense-temporal information (*SST*) classifications.

To clarify the above, certain facts must be pointed out. First, the general assumption of the chapter seems to be confirmed by ongoing practices: the fundamental shift to collaborative and mutual learning in the practice of evaluation, policy, and planning has caused an increasing aggregate demand for interactivity. Secondly, according to negotiation, communicative and cyber planning, and their corresponding evaluative practices, an increasingly higher level of inter-active participation is required. Third, the panorama studied overall confirms that researchers

are seeking visual intuition-based modelling both as a strategy for encouraging citizens' active participation and as a framework for shaping innovative man–computer interfaces. Fourth, the results of the *RVP* and *SST* taxonomies seem to indicate a shift in the design of the IPSS towards patterns that belong to the *RV* and *OMBS* domains. Radical movements of IPSS designers towards *VV* and *MMBS* domains still seem to be dominated by cautious behaviour. Fifth, with regard to the last point, information and communication technologies are sought to increase the level of interaction among different agents, rather than to substitute completely the concrete decisional settings with virtual screen-based remote environments. In other words, traditional physical debates still seem to be the indispensable basis for fair, transparent interactive evaluation.

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